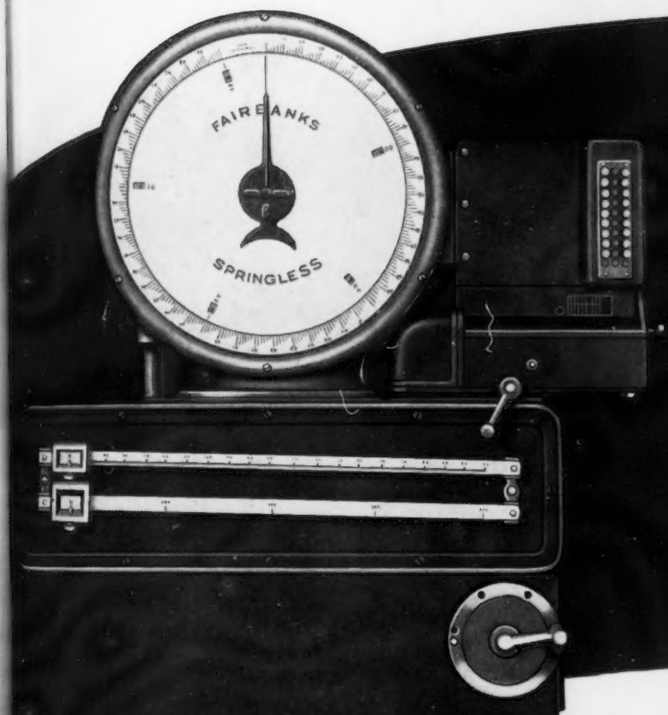
DECEMBER 18, 1941

The IRON AGE



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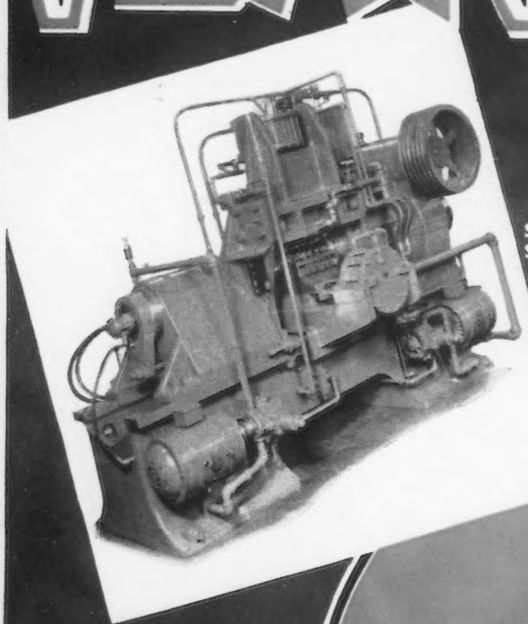

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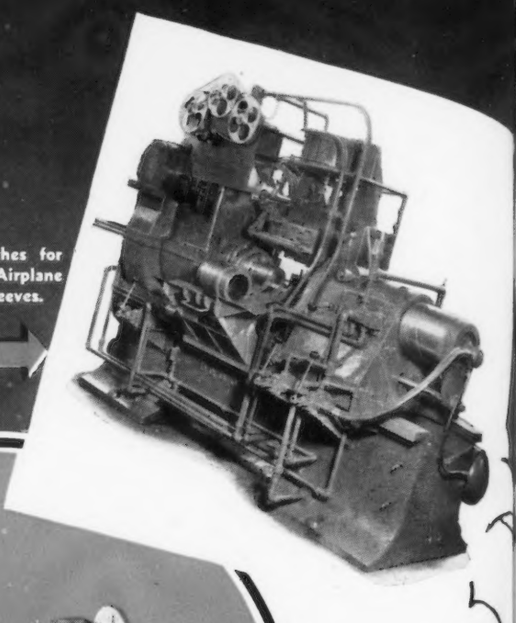

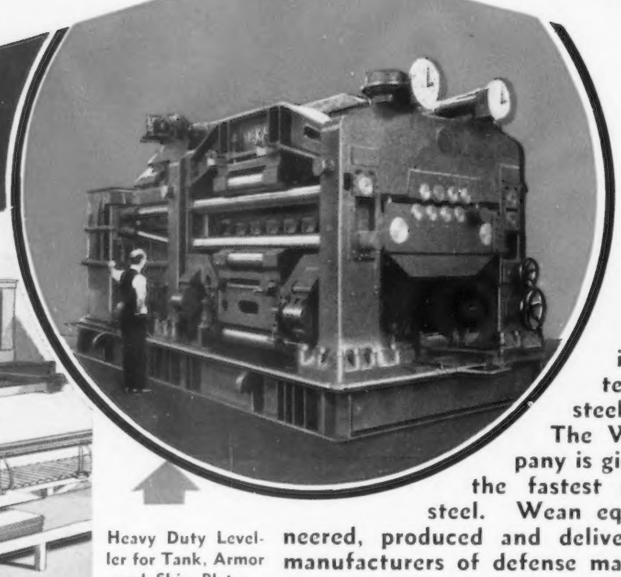

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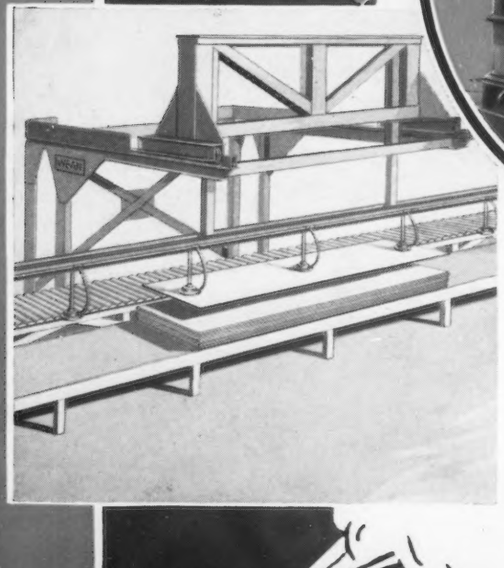

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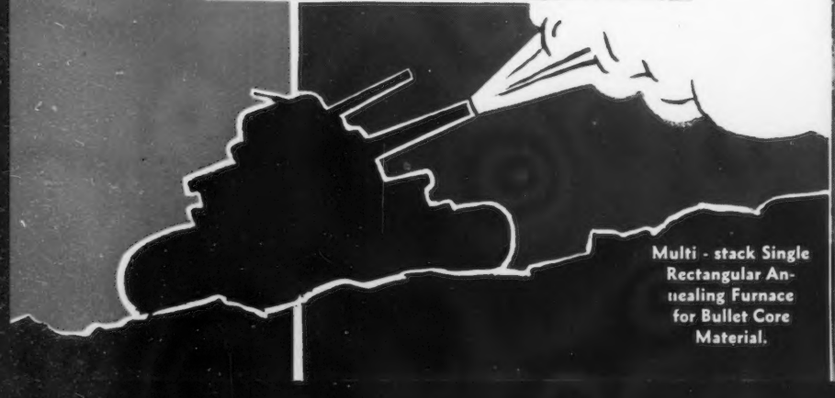

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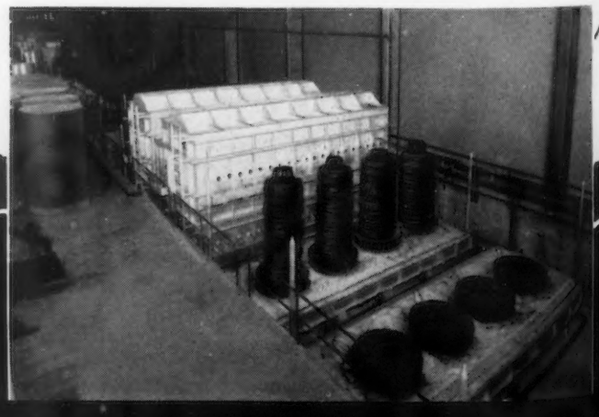

DECEMBER 18, 1941
VOL. 148, NO. 25

This Week in . . .

THE IRON AGE

"KEY PEOPLE"—*When You Need Steel*

Ryerson's function is not only to supply your steel, but to deliver it on time. From the moment the Ryerson switchboard flashes your incoming call until the steel is laid down in your plant, a corps of helpful, intelligent employees well-trained in the Ryerson "Immediate Steel" tradition are at your service.

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THE IRON AGE

DECEMBER 18, 1941

ESTABLISHED 1855

A Challenge Is Accepted

IN the newly opened battle arena of the Pacific, Japan has won the first round by means of a foul blow.

What else could have been expected? For months we have heard and read of the inevitability of our conflict with the Nipponese Lilliputians. And also have we heard and read many optimistic predictions as to the rapidity with which we would, in such an event, make a clean-up. Some of these statements have come from people who ought to know and they have varied, as to the time required by our Navy to do a thorough job, from an ultra-optimistic "half day's work," as one retired admiral put it, to a six months' job in more conservative Navy opinion.

You remember what the Lilliputians did to the giant Gulliver when they found him asleep. They knew very well indeed that they would not stand a chance to fight him under Marquis of Queensbury rules, so they jumped the gun.

If the little men of Nippon have taken our own estimate of our prowess seriously, and I assume they did, then their one hope of success in what they, too, considered an inevitable conflict was to do what those other little men did. To attempt to tie the giant down before he could make up his mind to act.

They did just that. And we should have expected something of this sort and have been ready for it. But their initial success in the first round will make no difference in the final outcome.

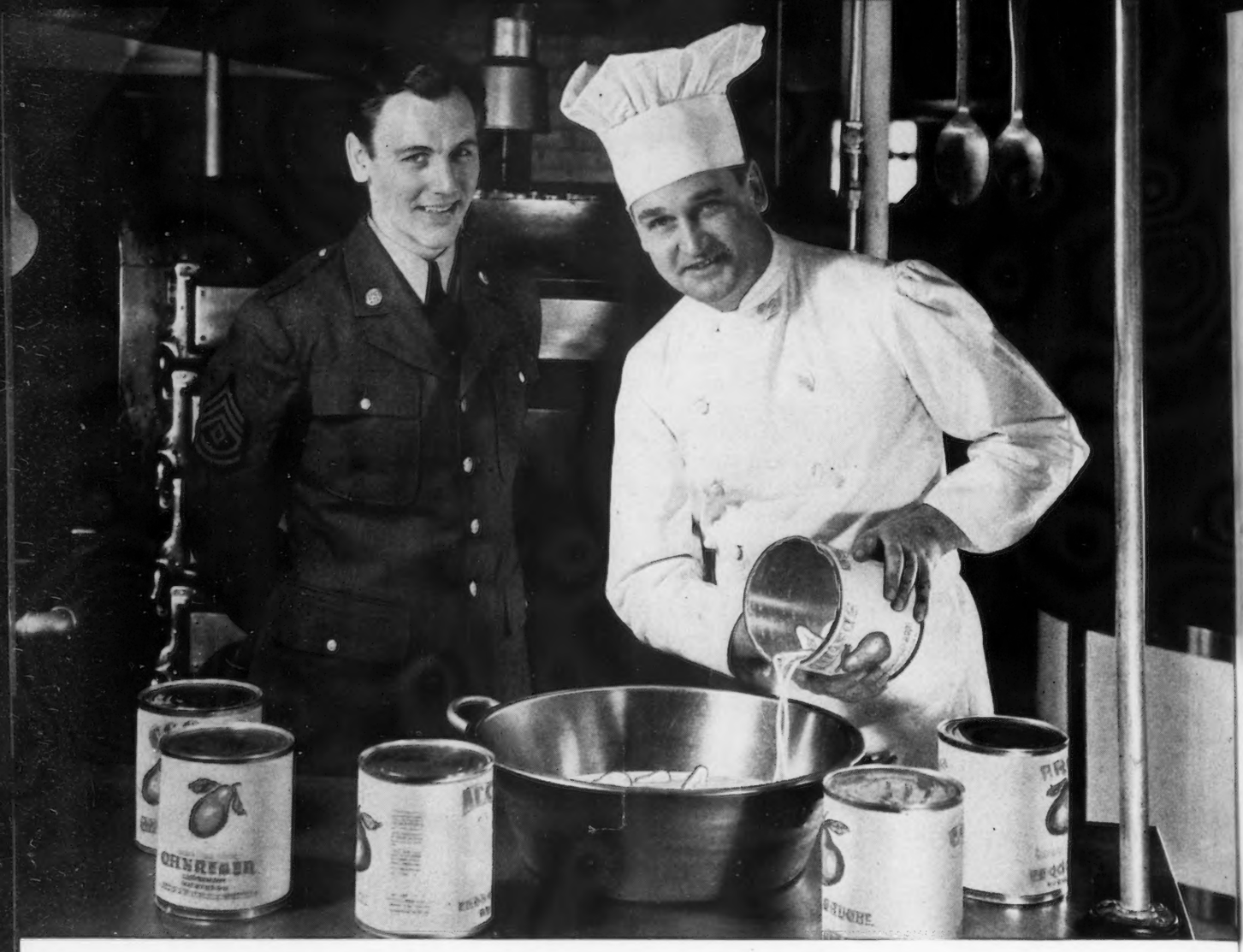
The final outcome will be decided on United States continental soil and not in the far flung reaches of the Pacific. It will be decided in the mines and the steel mills and the machine shops of America, which can outproduce Japan 10 to one in any needed mechanism of war.

Have dive bombers and heavy long range flying fortresses made the battleship obsolete? Then the productive forces of America will breed these locusts of destruction in such swarms as will darken the sky over the possessions of the Emperor who calls himself the "Son of Heaven."

Whatever may be required to win this war and to destroy forever the insane ambitions of the would-be dictators and imperialists, America will now produce. Be it ships or guns or tanks or planes, American factories will now work as never before to produce the means to destroy these monsters. Forgetting our former petty differences, employers and employed will from now on, until the ultimate victory, work tirelessly and cheerfully side by side toward the common goal of preserving the freedom of all men and women.

This is the solemn pledge that American industry gives to America in this crucial hour.

J. H. Van Deventer



Inland Tin Plate Also Plays Important Role in Defense Program

When Uncle Sam sets out to provide food for American soldiers and sailors it must be the very best—not only when bought—but, more important still, when the call for "mess" is sounded.

That is why our Government is purchasing vast stores of wholesome food—the finest meats, tree-ripened fruit, garden-fresh vegetables—with their purity, taste and nutritive value safely preserved in hermetically sealed tin cans.

Inland tin plate—made from the highest quality steel, tightly coated with pure virgin tin—is being used regularly by leading manufacturers who are producing many millions of these cans for the needs of our Army and Navy and, of course, for the civilian population. Inland tin plate is also widely used both in the United States and abroad in connection with our aid to nations resisting aggression.

Thus Inland tin plate takes its place with the many other Inland products now playing important roles in America's Defense Program—Inland's No. 1 Job.

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Fatigue Strength Improved by Flame Treatment

o o o

—Lengthy theoretical discussions of residual stresses appeared in THE IRON AGE, Sept. 18 and 25. Herein are data on the practical utilization of internal stresses, and also a correlation of such stresses with the fatigue strength of tubular axles. It is shown that residual stresses can be highly beneficial, rather than detrimental.

By O. J. HORGER
Head, Railway Engineering and Research,
and T. V. BUCKWALTER
Vice-President, Timken Roller Bearing Co., Canton

o o o

RAILROAD car axles are usually made from forged solid bars, and this report gives the results of fatigue tests made on tubular axles having about one-third less weight. While these tests were made on car axles the results may be applied to other problems wherever shafts are used. The press fit of a wheel, pulley, or gear on an axle introduces a very severe stress concentration; and axle fatigue failures, when they occur, often develop in the press fitted region.

In order to improve the fatigue strength of axles, the flame treating process was applied to the surface of the wheel seat which is a region of high localized stresses. This method gave more than 83 per cent greater allowable fatigue strength than axles in the as-rolled condition. Quenched and tempered axles were inferior in comparison with the as-rolled and flame hardened axles. Investigation was made of internal stresses in the tubular axles as a means of explaining these results and a correlation is shown between the fatigue strength and residual stresses. This correspondence indicates that the flame hardened and as-rolled axles, which had the highest fatigue strength, also had residual compressive stresses at the surface. On the other hand, the quenched and tempered axles, having the lower fatigue strength, had residual tensile stresses at the surface. The details of the research made on this problem are outlined in the following paragraphs.

TUBULAR AXLE DESIGN: A photograph of a test axle and wheel assembly is shown in Fig. 1, and the axle dimensions are outlined in the line diagram of Fig. 2. The size and shape of axles tested were identical at the wheel seat and in the body between the wheels to an axle which could be used in service under a modern railroad car.

The disk shown mounted on the axle represents a wheel and was pressed-on the axle in accordance with usual mounting practice as indicated in Table II. In this test the equivalent wheel was in agreement with existing material specifications for multiple wear wrought steel wheels, and the scleroscope hardness measured 35 to 37 on the hub face of the wheel.

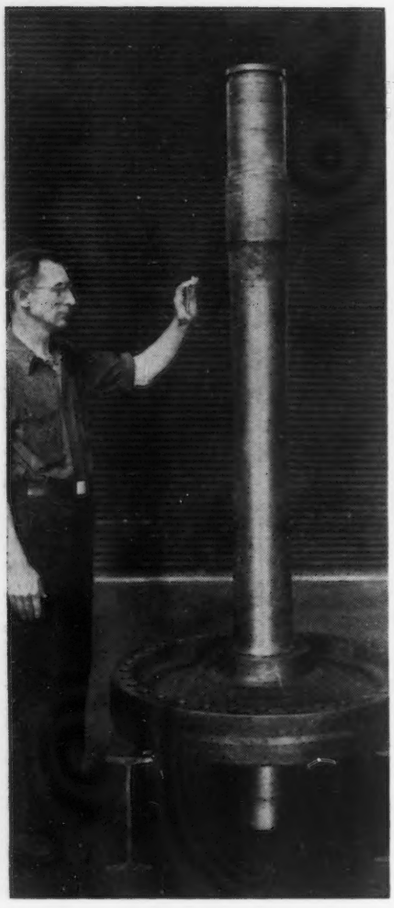
MATERIAL: All test axles were made from the same heat of S.A.E. 1045 steel. Chemical analysis and physical properties of samples from test axles are shown in Table I.

These tubular axles were rolled on a Mannesman mill to a 7¾-in. outside diameter with a wall thickness of 1⅝ in. No intermediate forging or forming operations were used. After heat treatment the axles were machined all over on the outside diameter but the bore was not machined.

HEAT TREATMENT: These tubular axles were tested in three conditions, as follows: (a) hot rolled; (b) quenched and tempered, and (c) flame hardened.

The hot rolled tubes in (a) were spaced apart and allowed to cool in still air on cooling beds immediately after passing through the tube mill. Photomicrographs made at the outside and inside diameters of such a tubular axles are shown in Fig. 3.

The tubes in (b) are the same as in (a) except they were first normalized at 1650 deg. F., reheated to 1500 deg. F. and then quenched in water for six min., during which time the tube was moved up and down and endwise in the water. Both ends of the tubes were capped with sheet metal plates welded to the tube at intermittent points. These caps did not entirely prevent the entrance of water inside the tube but did restrict the flow. Fol-



ABOVE

FIG. 1—Fatigue tests made on tubular axle assembly shown here. Note size contrast between usual fatigue test specimen in workman's hand and full size axle.

o o o

BELOW

FIG. 2—Detail of test axle assembly.

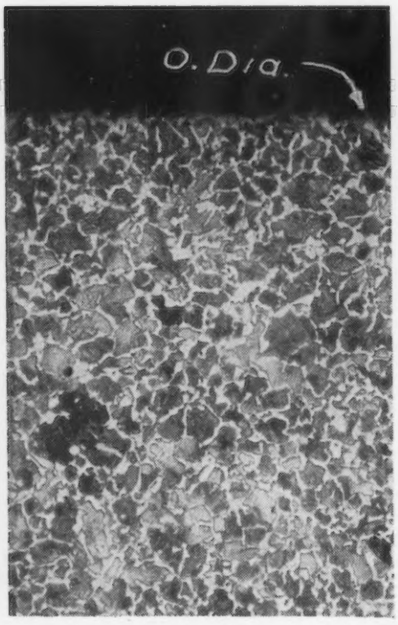
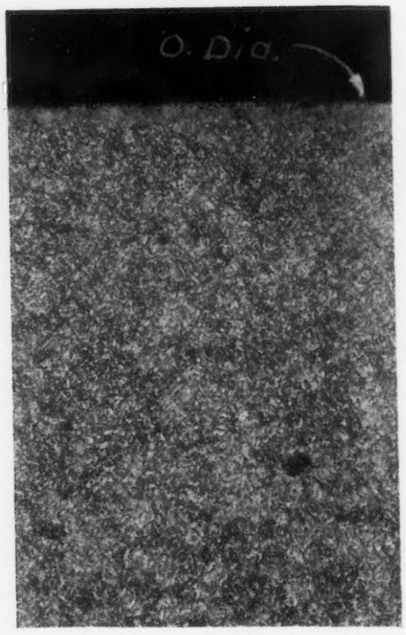


FIG. 3—Longitudinal section of as-rolled tubular axle No. 372. At 100 diameters.



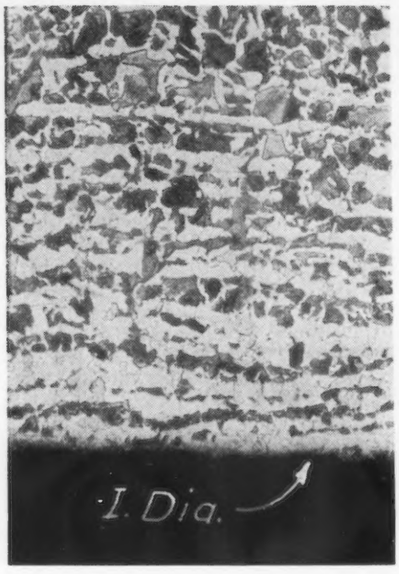
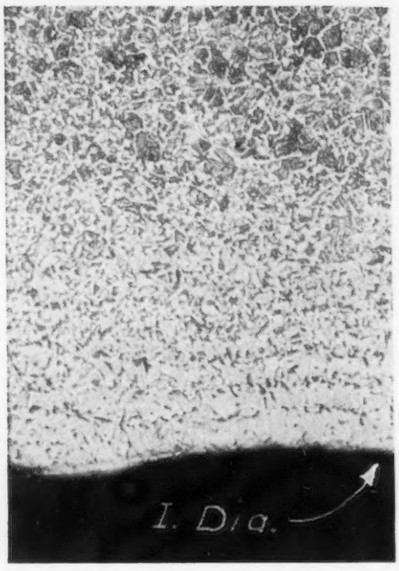
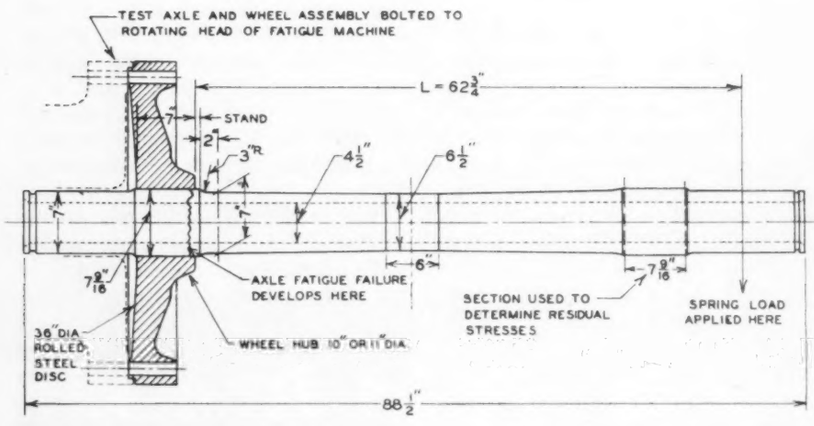
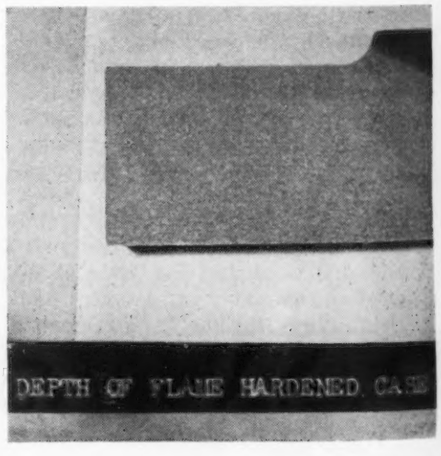
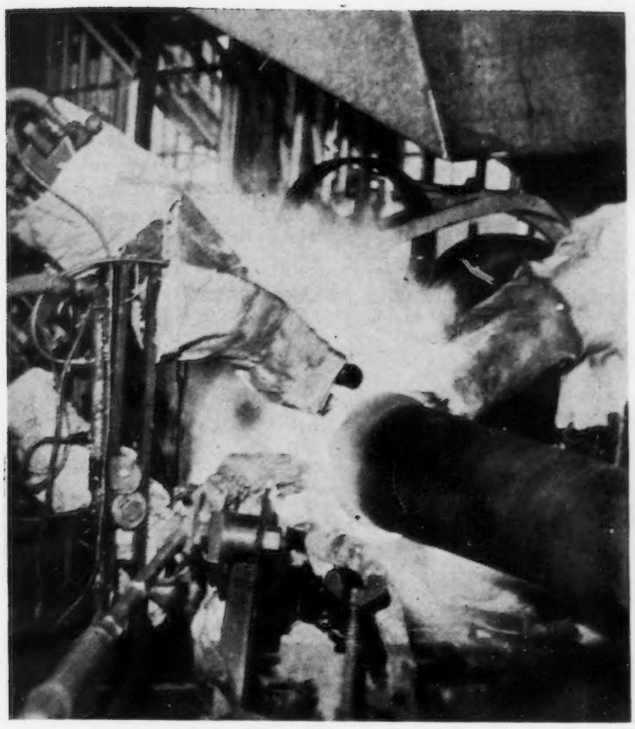


FIG. 4—Longitudinal section of quenched and tempered axle No. 375. At 100 diameters.









ABOVE

FIG. 5—Method of flame hardening tubular axle.

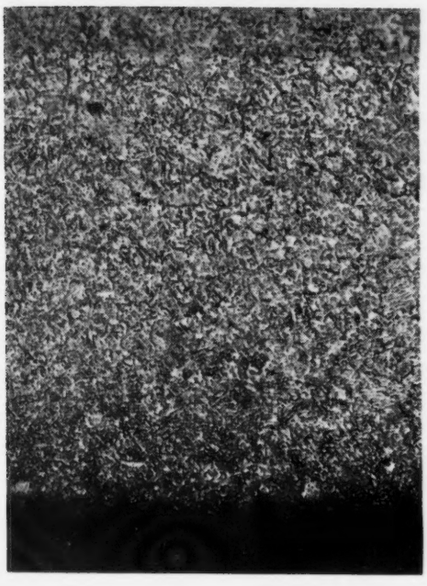


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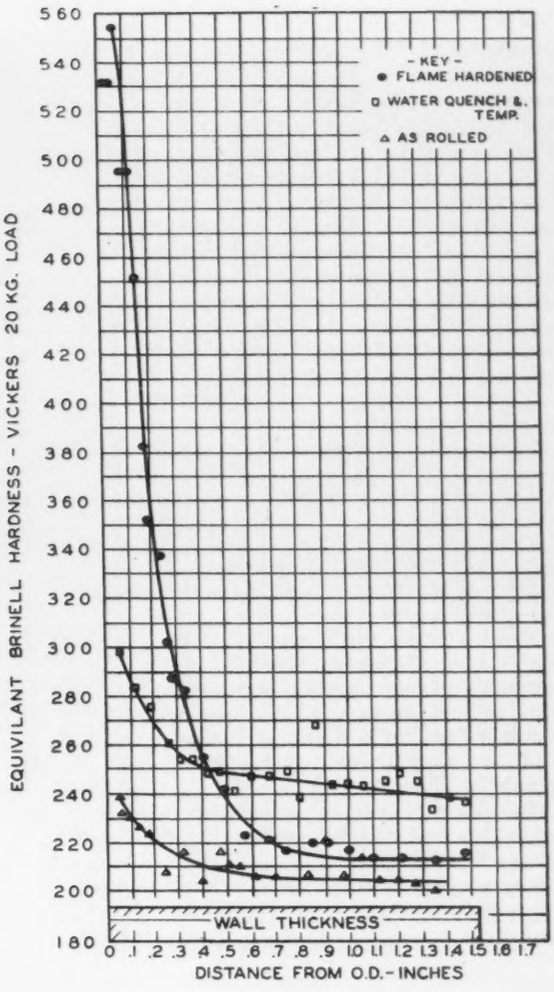
FIG. 6—Longitudinal section of flame hardened wheel seat. At 100 diameters.

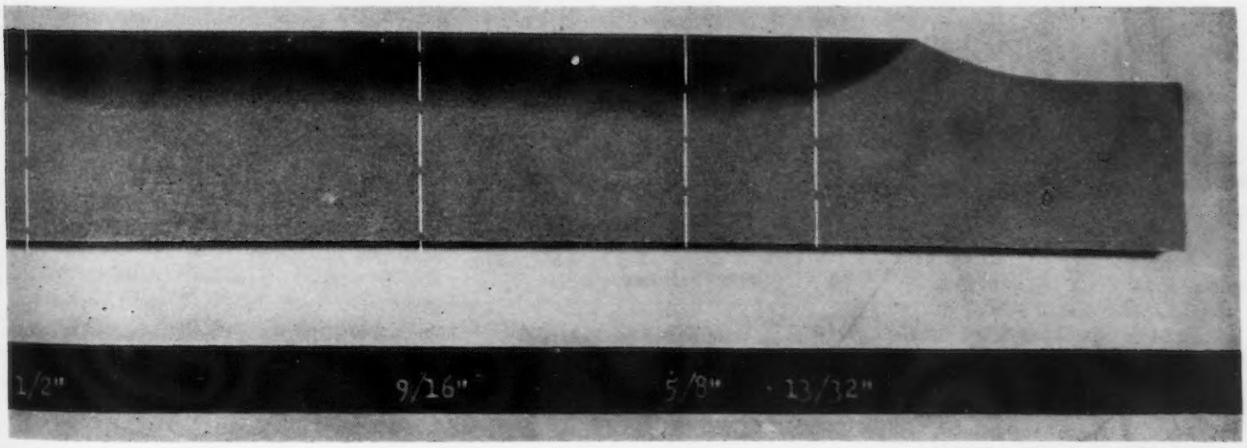


ABOVE

FIG. 8—Hardness through cross-section of axles with various treatments.

BELOW

FIG. 7—Longitudinal section of flame hardened wheel seat. At 0.72 diameters.



lowing the quench, the tubes were tempered at 1050 deg. F. and allowed to cool in still air. Photomicrographs made at the outside and inside axle diameters are shown in Fig. 4.

The tubes in (c) are the same as in (a) except they were first normalized at 1650 deg. F. and then only the wheel seats of each axle were flame hardened. The method of flame hardening is presented in Fig. 5, where the axle is shown being rotated in lathe centers at 110 r.p.m. in a field of four equally spaced flame hardening heads. Heating time varied from 2 to 2½ min., after which time the surface was water spray quenched and then drawn in oil at 350 deg. F. for one hr. Scleroscope surface hardness was 30 before flame hardening and varied from 50 to 70 after flame treatment. This surface was then ground for the wheel fit removing about 1/32 in. on the diameter. A photomicrograph taken through a longitudinal section of the flame hardened region is shown in Fig. 6, and a longitudinal photomicrograph is given in Fig. 7.

Results of hardness explorations through a longitudinal cross-section of the tubular axles treated in different manners are shown in Fig. 8.

METHOD OF TEST: These axles were tested on large double-end rotating cantilever beam fatigue machines. The axle is supported in the test machine by bolting the rim of the wheel to a rotating head of the fatigue machine, operating at about 1500 r.p.m. A constant spring load is applied on the opposite axle journal. This method of loading, shown in Fig. 2, applied a bending moment on the axle of the same shape as that employed by the designer when using a combination of vertical and lateral forces (Reuleaux Method) to determine axle size.

The stresses expressed in this article refer to the nominally calculated axle bending stresses at the end of the wheel fit, as shown in Fig. 2. Here the bending moment is equal to PL, and this product is divided by the section modulus of the axle to obtain the bending stress. For convenience of comparisons made later, the bending stress is expressed in Table II for the actual test axle as a tubular section and also as if the axle were a solid section.

TABLE I

Chemical Composition and Physical Properties

Chemical Composition		Physical Properties		
			Hot Rolled[a]	Water Quenched and Tempered[a]
Carbon	0.50	Yield strength, lb. per sq. in.[b]	61,000 to 63,500	72,000 to 81,000
Manganese	0.73	Tensile strength, lb. per sq. in.	103,500 to 106,000	119,000 to 120,000
Phosphorus	0.017	Reduction of area, per cent	41.9 to 42.2	47.2 to 50.6
Nickel	0.25	Elongation, per cent	22.0 to 23.0	20.5 to 21.5
Chromium	0.13	Brinell hardness (end tensile specimen)	183 to 192	217 to 223
Sulfur	0.015	Izod impact, ft-lb.	13 to 16	17 to 23
Silicon	0.27			

[a] Tensile specimens taken from center of wall thickness ½ in. diameter by 2 in. gage length.
[b] Determined by drop-of-beam method.

TABLE II

Results of Fatigue Test

Test Axle No.	Wheel Mounting Conditions				Calculated Axle Bending Stress at Inside Hub Face, Lb. Per Sq. In. on Basis of:		Axle Life		Remarks as to Axle Condition in Wheel Fit After Test
	Wheel Hub		Wheel Fit on Axle, In.	Tonnage	Solid Axle of Same Diameter Tested as Tubular	Actual Hollow Axle Tested	Revolutions, Millions	Equivalent Miles on 36-In. Wheel	
	Diameter, In.	Stand, In.							
As-Rolled Condition									
372	10	½	0.0080	80	19,000	21,700	1.07	1,910	broken
373	10	½	0.0113	90	17,000	19,400	0.68	1,210	broken (Fig. 9)
371	10	⅛	0.0115	110	13,500	15,300	6.90	12,300	broken
374	10	⅛	0.0103	95	12,000	13,500	18.01	32,100	in test
Water Quenched and Tempered									
376 (a)	10	½	0.0115	100	19,000	21,500	0.40	708	broken
375	10	⅛	0.0120	115	13,500	15,200	4.87	8,690	broken
378	10	⅛	0.0107	103	12,000	13,700	4.20	7,480	broken
Flame Hardened									
381	11	⅛	0.0163	120	19,000	21,600	89.1	158,700	not cracked
382	11	⅛	0.0123	150	19,000	21,500	99.6	175,500	not cracked
381A	11	⅛	0.0140	90	22,000	25,180	85.7	152,600	not cracked

The safe design values or endurance limits given in Table III are based on a test of at least 84.3 million axle revolutions, which is equivalent to 150,000 miles on 36-in. diameter wheels.

DISCUSSION OF FATIGUE TESTS: Fatigue tests made on these various axles gave the results shown in Table II. All fatigue failures developed from the outside diameter, not from the bore, and in the axle wheel fit. A typical axle failure is shown in Fig. 9.

Table III summarizes the allowable fatigue strength values for the wheel seat portion of the various axles expressed as an equivalent stress for a solid axle. Few, if any, axles are at present in railroad service with a wall section as thin as the ones reported in these tests. For this reason it is convenient to express the results of these tubular axle tests in a form which permits a comparison with existing solid axles. If we assume the axle forces produced in service to be the same whether a hollow or solid axle is used, then it is convenient to state the stress for the hollow axle as an equivalent stress on a solid axle. This equivalent stress, for the endurance limit values in Table III, therefore, expresses a comparison of the load carrying capacity of the tubular axles tested with a solid axle of the same outside diameter.

It should be mentioned here that solid axles*, tested in a manner similar to the tubular axles, of a 0.50 per cent plain carbon steel in the as-forged condition, gave an endurance limit of 12,000 lb. per sq. in. This value is the same as the fatigue strength of the as-rolled tubular axle stated in Table III. The tubular axle weighs about one-third less than the solid. Since a railroad car axle represents an unsprung mass it is desirable to reduce such weight to a minimum so as to reduce impact stresses.

It would generally be expected that the quenched and tempered tubes would offer greater fatigue resistance than the as-rolled axles from a comparison of the physical properties (Table I), hardness values (Fig. 8), and microstructure (Figs. 3 and 4). This expectation is not in accordance with the findings, but a discussion of this is offered later. Sufficient tests were not made on the quenched and tempered axles to determine how much the endurance limit would drop below the 12,000 lb. per sq. in. value.

Without the benefit of these fatigue tests, it may be expected that the flame hardened axle be superior to the other axles investigated. Sufficient tests were not made on the flame hardened axles to determine how much the endurance limit would be above the 22,000 lb. per sq. in. shown in Table III, but this value represents an increase of 83 per cent over the as-rolled axles.

Results of fatigue tests, reported in the literature, on members having severe stress concentrations, equivalent to a press fit, have shown that of two steels (or the same steel but differently heat treated), the one having the higher hardness and physical properties will sometimes exhibit the lower fatigue strength. In such tests it is often reported that the fatigue strength of the higher tensile steel with the presence of high stress concentration approaches that of the material having lower static properties. The reason for this is usually ascribed to the greater capacity of the low strength over the high strength materials for yielding and distributing peak local stresses. This explanation fails to account for the results obtained with these tubular axles and also the findings of some other investigators with fatigue specimens having sizable stress concentration. A much neglected factor in current knowledge of fatigue, and one which is of substantial practical importance, is the presence of residual stresses and their influence on fatigue strength. It was believed that an analysis of residual stresses in these tubular axles may provide some correlation with the fatigue strength obtained, and so such an examination was made.

RESIDUAL STRESSES: The wheel seat section was machined from one full size axle of each of the three types of treatments, using wheel seat portions which had not been subjected to fatigue test as indicated in Fig. 2. These tubular sections were used to make a determination of the residual stresses present, and measured approximately 7 9/16 in. on outside diameter after grinding, by 4 7/16 in. inside di-

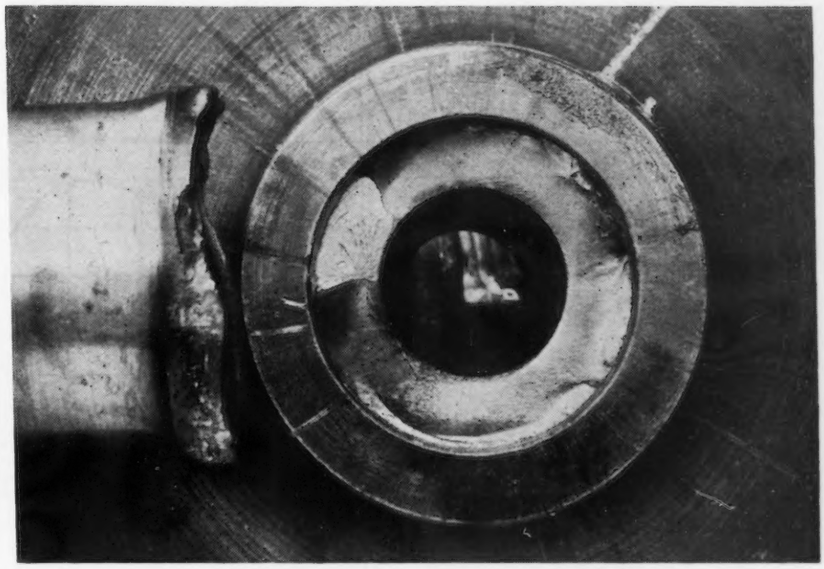


Fig. 9—Tubular test axle broken off in wheel fit.

TABLE III

Endurance Limit Values for Tubular Axles

	Endurance Limit Value	
	Lb. Per Sq. In.[a]	Per Cent[b]
(1) Flame hardened	>22000	>183
(2) As-rolled	12000	100
(3) Quenched and tempered	<12000	<100

[a] Equivalent stress for solid axle of same diameter as tubular axles tested.

[b] Ratio of equivalent stress or load carrying capacity of tubular axle with a solid axle of same diameter.

*"*Passenger Car Axle Tests 5½ x 10 in. Journals*," Fourth Progress Report, Assn. Am. Railroads, Chicago, April 1, 1940.

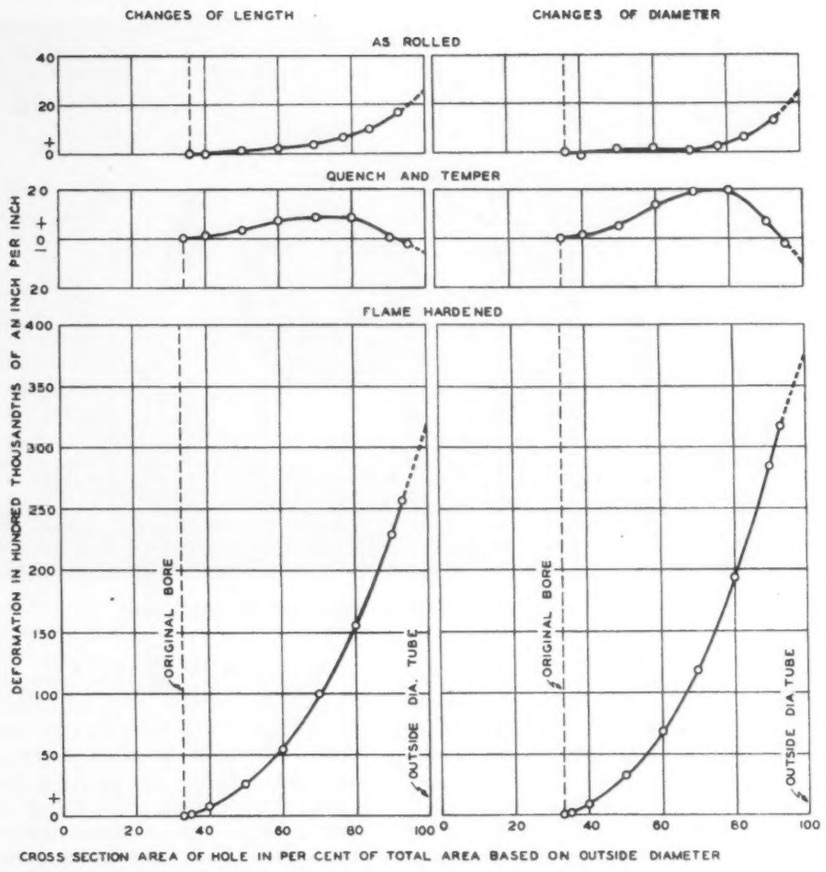


Fig. 10—Deformations of tubular axles after successive boring-out operations.

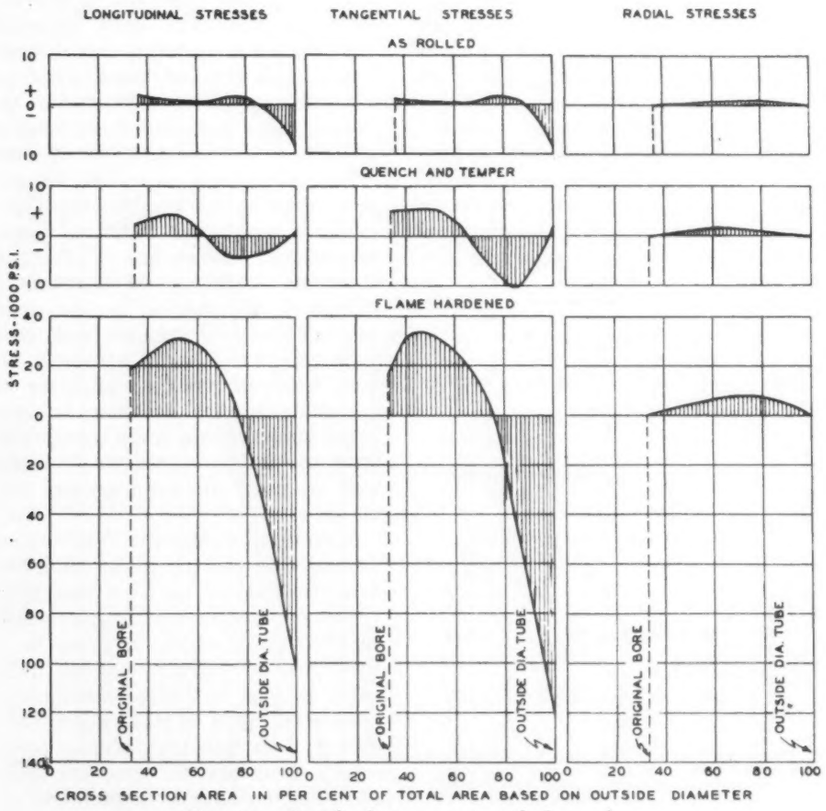


Fig. 11—Residual stresses in tubular axles.

ameter after smooth turning sufficiently to clean up the bore, by 7 9/16 in. long after grinding.* Sachs' boring-out method† was used wherein each cylinder was successively bored out and the changes in length and outside diameter measured after removing 5 to 10 per cent of the cross-section area. A small amount of metal was removed in each boring and a series of cuts was required between each stage of making measurements so as to minimize the influence of heating and machining stresses. All measurements were made using a Zeiss Optimeter, which permitted reading length and diameter dimensions directly to 0.0001 in. and estimating to at least 0.000025 in. The average of six diameter measurements, maximum and minimum, made at three different cross-sections and the average of 12 length measurements made at four equally spaced locations on the wall thickness were determined after each series of boring-out operations. The cylinders were allowed to reach equilibrium temperature in a gage room where all measurements were made under constant temperature and humidity conditions.

The results of the changes in diameter and length for these cylinders after boring out successive layers from the inside of each tube is shown in Fig. 10. From these deformations the residual stresses throughout the cross-section, were calculated†, as shown in Fig. 11.

RESIDUAL STRESSES VS. FATIGUE STRENGTH: A correlation is shown in Fig. 12 between the residual stresses present at the outside diameter of the tubular axles (Fig. 11) with the fatigue values (Table III). It will be observed that the as-rolled and flame hardened axles have residual compression stresses in the surface and exhibit higher fatigue values than the quenched and tempered axle, which have resi-

It would be desirable to use sections where the length was at least three times the diameter, but this could not be done using the axle design shown.

†*"The Determination of Residual Stresses in Rods and Tubes," by G. Sachs, Zeitschrift für Metallkunde, Vol. 19, 1927, p. 352-357.*

"Practical Metallurgy," by G. Sachs and K. R. Van Horn, American Society for Metals, Cleveland, 1940.

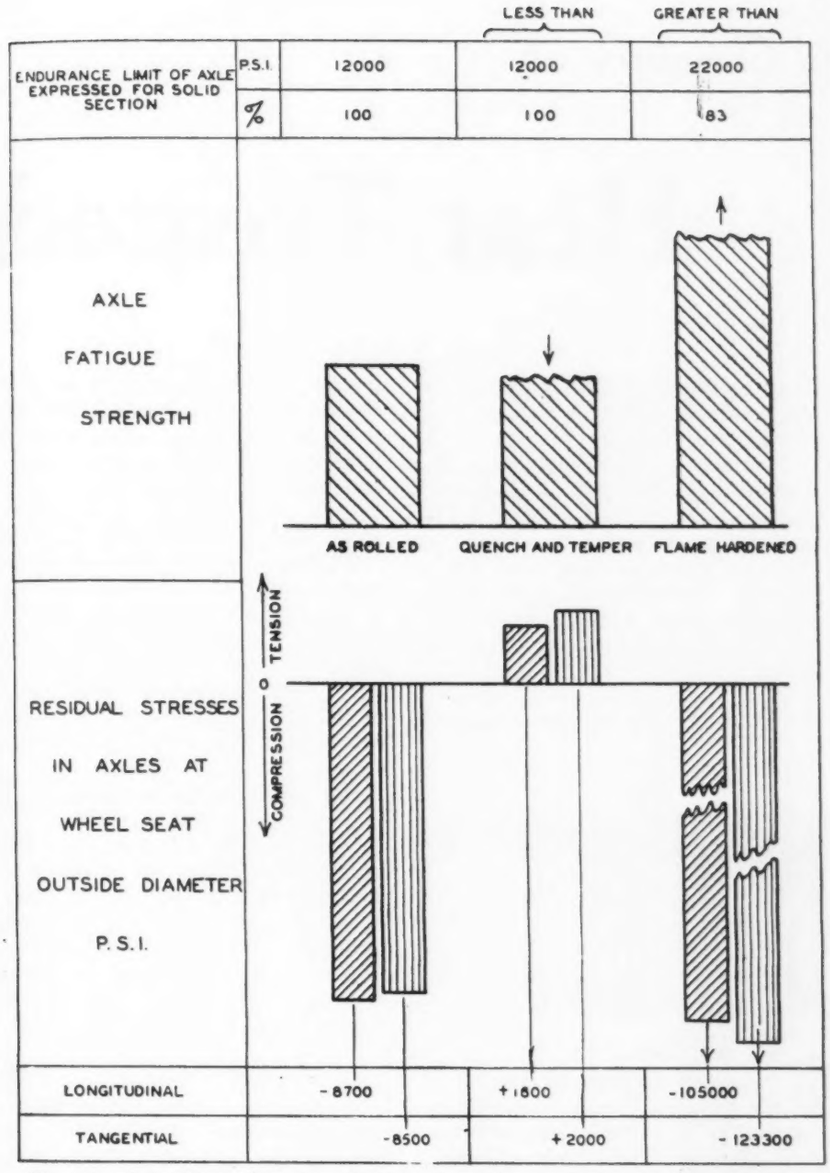


Fig. 12—Correlation between fatigue strength and residual surface stresses.

dual tensile stresses in the surface.

Somewhat similar findings regarding residual stresses have been reported by Bühler and Buchholtz*

*"*Effect of Residual Stresses on the Dynamic Strength,*" by H. Bühler and H Buchholtz, Mitt. a.d. Forschungs—Inst. d Ver. Stahlwerke Akt., Dortmund, vol. 3, No. 8, Sept. 1, 1933.*

on smooth shafts of various steels about 1 in. diameter. The alternating bending fatigue strength was increased by as much as 15 to 20 per cent by compressive stresses at the boundary, as compared with the same material annealed and having zero residual stresses. High compressive stresses in the surface were obtained by different heat treatments which produced little or no change in the tensile properties of the steel. When these boundary conditions on a silico-manganese steel were changed from zero residual stress to tensile stresses, then the fatigue strength was decreased by values up to about 15 per cent.

These tubular axle tests do not isolate the influence of internal macrostresses from the variations in microstructive and microstresses as they affect the fatigue strength. The association shown between internal stresses and fatigue strength are interesting. It would appear that the proper utilization of residual stresses offers considerable possibilities. Further research is necessary in order to obtain an understanding and a practical basis of control which may be exercised in obtaining favorable residual stresses.

Improvements In Wire Making Technique

THE George W. Prentiss Co., Holyoke, Mass., recently developed a wire-drawing bench using variable voltage Westinghouse motors. Rheostats and mechanical connections used in present methods of wire drawing are eliminated. Once the proper field adjustments are made to each motor, it is stated, they can be simultaneously started from standstill, operate at low speeds for threading and attain full running speeds simply by raising the supply voltage.

The motors are said to maintain their speed ratios so exactly that the tension on the wire is constant on each side of every die, resulting in greater mechanical and operating simplicity. It is said that breaks in the wire occur less frequently and starts are smoother.

Of interest to wire cloth manufacturers for screens, filters, sifters, etc., is the new Quill Winder recently developed by the Fidelity Machine Co., Philadelphia, for accurate taper winding at high speeds. The machine, equipped with an easily regulated hydraulic control, winds six packages at one time with uniformly even lay and taper.

The taper is automatically governed by control buttons that reverse and successively shorten the traverse in the same operation, assuring free-running wire from shuttles in the weaving operation. A clutch regulates the tension to conform to speed and pick-up, eliminating wire breakage.

Surface Structures and Chemistry of

Heat Treated

THE preceding two sections of this article dealt with a general review of the experimental objectives and procedure; metal oxide zone; treating from a smith forge; preheating; effect of superheating vs. atmosphere of surface carbon; water quenching, etc. Herein, attention is first directed to miscellaneous furnace treatments. The information given last week indicates that the heat treatment of 18-4-1 high speed steel is a rather simple operation. However, there are certain exceptions to the general rules, of which the following are examples:

Sections which have blind holes present a problem. A study of several sections which had blind holes invariably showed some areas to be decarburized while other areas showed carburization. A more thorough study of sections of this type was made as follows: Six specimens, 1 in. round x 3 in. long with a 0.5-in. hole, drilled longitudinally 2.5 in. deep, were treated in atmospheres of 15.5, 9.8, and 4.8 per cent carbon monoxide; 0.5, 3.0 and 6.3 per cent oxygen. These samples were preheated in a 2 per cent carbon monoxide atmosphere at 1550 deg. F. for 15 min., followed by superheating to 2350 deg. F. for a total time of 5 min. The examination of these specimens, regardless of the furnace atmosphere, showed that the entrances to the holes were badly decarburized, while the bottoms were excessively carburized; in fact, they carburized to such an extent that some eutectic was present.

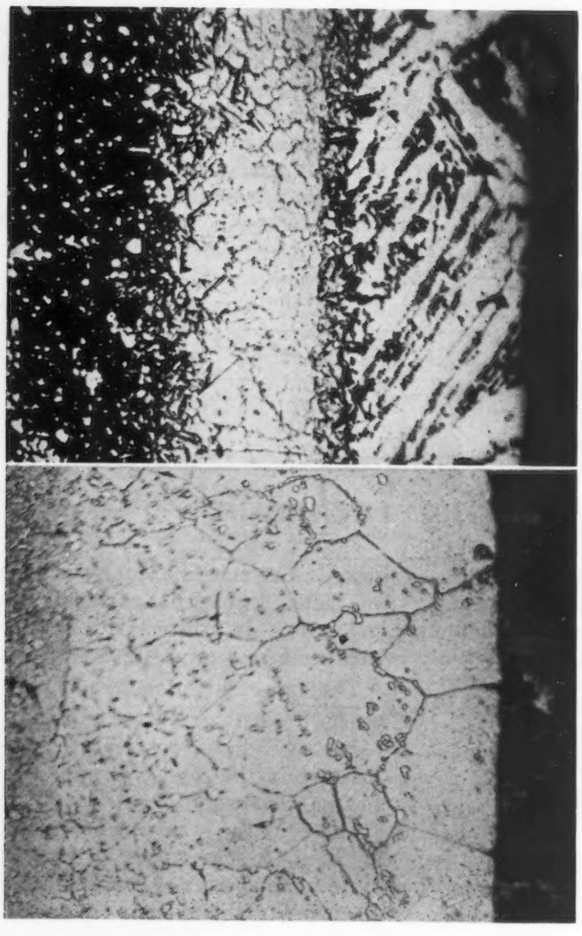


FIG. 42 (top)—Oil quenched from 2350 deg., drawn 1050 deg. Carburized zone at base of a blind hole. Fig. 43 (bottom) — Oil quenched from 2350 deg., drawn 1050 deg. Decarburization caused by surface contact of the material with the furnace hearth. Both at 500 diameters.

Fig. 42 shows the microstructure of the base of one of these holes. An examination of this photomicrograph shows that the carburized area has four distinct fields: first, eutectic; second, untransformed austenite; third, partially transformed austenite (which is characterized by the martensitic needles); fourth, a normal structure.

Several tests were made with holes slightly smaller and slightly larger than ½ in. in diameter. In each instance, it was found that both decarburization and carburization took place. Examination of the structures from the entrances to the bottoms of the holes showed decarburization, neutral areas and highly carburized areas. The neutral areas were usually found midway between the entrances and the bottom of the holes.

Another condition which is frequently encountered is a change of surface carbon on the face in contact with the furnace hearth. When using atmospheres of 12.0 per cent carbon monoxide or under, for instance, the surface in contact with the hearth was often decarburized. This condition was checked quite thoroughly with sections ½ in. square x 4 in. long. When the test sections made close contact with the

18-4-1 Steel

By W. A. SCHLEGEL
Metallurgical Department
Carpenter Steel Co.
Reading, Pa.

hearth or stainless steel trays, decarburization took place. However, if the material was supported so that the atmosphere had free circulation, this condition did not occur. It does not necessarily follow that decarburization will take place on the surface in contact, but from the numerous tests which have been made, the indications are that the closer the contact between the material and the hearth, the greater the possibility for decarburization. Fig. 43 shows decarburization on a fractured cross-section of the face which was in contact with the hearth; Fig. 44 shows the microstructure of a decarburized area caused by surface contact.

When the atmospheres have a relatively high percentage of carbon monoxide (13 to 16 per cent) and the material makes close contact with the hearth, excessive carburization is likely to take place. Fig. 45 shows the surfaces of several tools which were treated in a 14 per cent carbon monoxide atmosphere, and which have wrinkled surfaces due to extreme carburization. The surface of a tool which showed this condition was analyzed for surface carbon by milling five steps of 0.005 in. from the wrinkled face. The results of these carbon analyses (in per cent) follow: Step 1 = 1.18; step 2 = 0.86; step 3 = 0.76; step 4 = 0.74; step 5 = 0.72.

The condition of carburization or decarburization on the surface in contact with the hearth may be minimized by placing tools in the furnace on the surface which will have little or no service in actual operation. Both conditions can be eliminated by having the atmosphere move freely around the work. This can be accomplished by supporting the tools above the hearth on suitable screens. In supporting tools, extreme precaution must be taken to prevent warpage due to the high temperatures employed in treating this steel.

Borax is occasionally used in certain types of treating to protect the surfaces. This method of treating was investigated with a specimen 1 in. round x 3 in. long, which was preheated in an atmosphere of 2 per cent carbon monoxide to a temperature of 1500 deg. F. for a total time of 20 min. When preheated, the specimen was rolled in anhydrous borax, heated to 2350 deg. F., total time 7 min., and oil quenched. The borax coating after treating was removed by sand blasting. The portion of the specimen where the borax accumulated during the superheating was highly carburized, while that portion from which borax had drained showed neither carburization nor decarburization.

Fig. 46 shows the structure where the borax had accumulated during the superheating period, and Fig. 47 shows the structure from which the borax had drained.

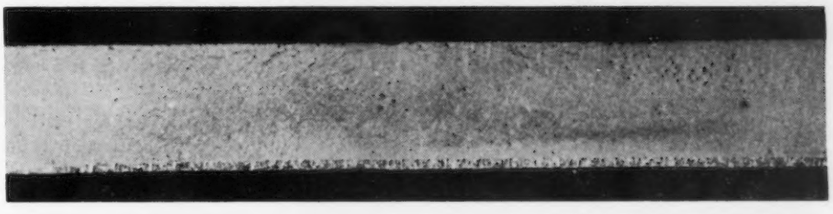


FIG. 44—Decarburization caused on surface in contact with hearth when oil quenched from 2350 deg. F. Excessive decarburization in this type of steel is generally characterized by very coarse grains. Twice actual size.

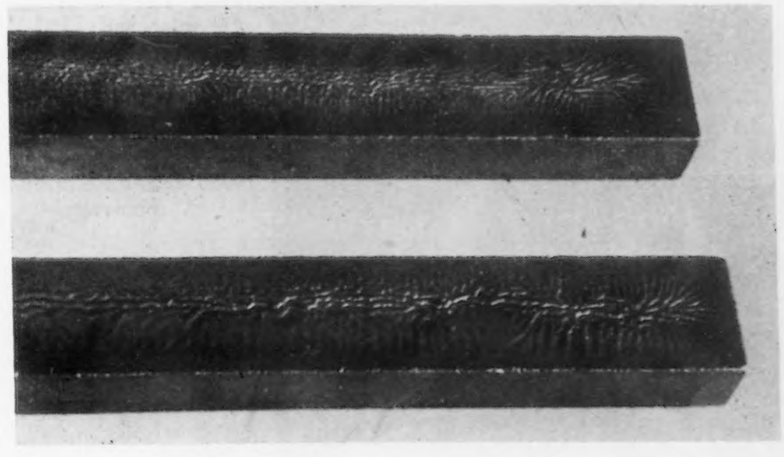


FIG. 45—Wrinkled surfaces caused by excessive carburization. This condition may occur on contact surface in highly reducing atmospheres. Actual size.

Fig. 48 illustrates the structure of the carburized area after drawing at 1050 deg. F., and was obtained on the same sample from which Fig. 46 was taken. It is difficult to explain why this specimen showed excessive carburization (Fig. 46) where the borax accumulated, while the area from which the borax drained (Fig. 47) was neutral. The author is of the opinion that the scale which formed during the preheat contained carbides, and when the borax coating was applied and the sample transferred to the high speed furnace, the borax drained toward the base of the specimen, carrying with it both scale and carbides. After the specimen had reached a relatively high temperature, the carbides in the scale came into contact with the surface, resulting in carburization.

Carbon blocks are frequently used in the heat treating of high speed steels to develop atmospheres which protect the surfaces from excessive scaling and to prevent decarburization. To study the behavior of the surface in treating under these conditions, a specimen 1 in. round x 3 in. long, was treated from a carbon block having inside dimensions of 1½ x 4 x 10 in. The specimen was heated to a temperature of 2350 deg. F. for a total time of 10 min., followed by oil quenching. The analysis of the surface carbon in steps of 0.005 in. on the diameter follows:

Step 1 = 1.09; step 2 = 0.78; step 3 = 0.70 per cent.

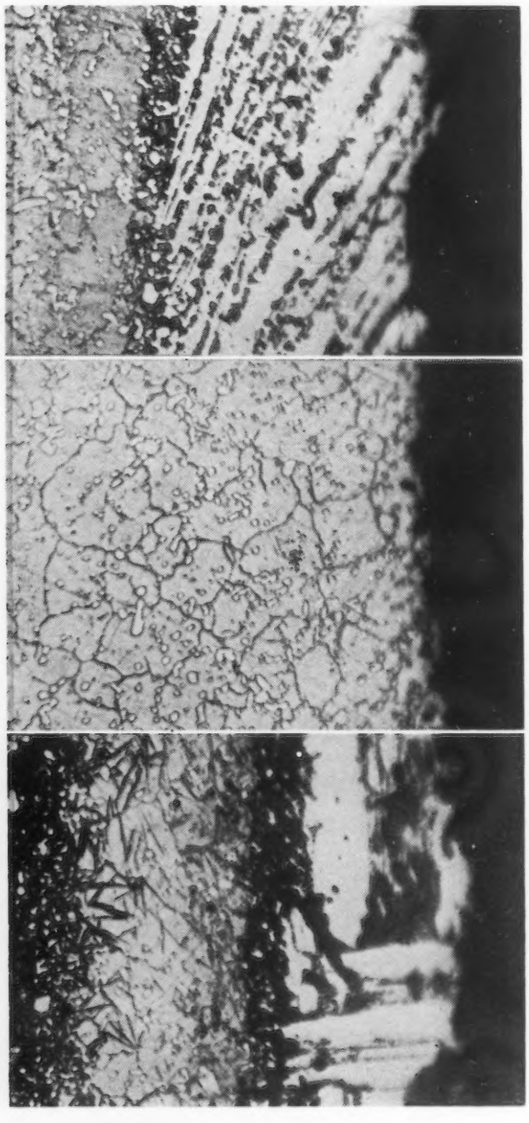
The analysis of the gas generated in the carbon block was:

Carbon dioxide—nil.

Oxygen—nil.

Carbon monoxide—32 to 33 per cent.

Fig. 49 shows the structure of this specimen as oil quenched, and Fig. 50 shows the structure as oil quenched and drawn at 1050 deg. F. for a total time of 1½ hr. Fig. 50 is interesting, since it shows that some of the retained austenite is partially decomposed by tempering as indicated by the large black martensitic needles.



FIGS. 46 to 48—Microstructures of section coated with borax during the superheat. Fig. 46 (top)—Oil quenched 2350 deg., no draw; section where borax accumulated during the superheat period. Fig. 47 (center)—Oil quenched 2350 deg. F., no draw; section from which borax drained when being superheated. Fig. 48 (bottom)—Same as Fig. 47, after drawing at 1050 deg. F. All at 1000 diameters.

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Salt Bath Heat Treating

In addition to furnace treating, this type of steel may also be treated from salt baths. The amount of salt bath treating undoubtedly will increase in the future due to the fact that a great deal less oxidation takes place during this treatment. In addition, the development of ceramic pots has materially reduced the cost and the number of failures in pot life. Data were secured on two different types of salt baths; the first, having a borax-boric acid base; the second, a barium chloride base. The test sections were 1 in. in diameter x 3 in. long, and the temperatures were 2300 deg. and 2350 deg. F. The time at heat in the superheating salt ranged from 2 to 15 min. A general practice when employing salt baths is to preheat in the temperature range of 1500 deg. to 1600 deg. F., followed by superheating to around 2350 deg. F. After tools are at the superheat, they are quenched into a third salt bath, which usually is operated in the temperature range of 1000 deg. to 1200 deg. F. The carbon analysis of the samples which were treated in the borax-boric acid bath are given in Table XV. When these samples were treated in this type bath, they were preheated in a potassium chloride-sodium carbonate bath to a temperature of 1600 deg. F. After reaching the superheating temperatures, they were quenched into a third bath operated at a temperature of 1150 deg. F. This quenching bath also consisted of potassium chloride-sodium carbonate. It is interesting to observe that the material treated from this type of equipment showed carburization, similar to that which is obtained in furnace treating. The set which was treated from the barium chloride high speed bath (included in Table XV) was preheated in a chloride base to a temperature of 1500 deg. F., and was quenched from the high heat bath into a quenching bath which was

held at a temperature of 1250 deg. F. This third bath contained some sodium cyanide which may explain the carburization which took place.

Explanation of Carburizing Action

The subject of surface chemistry is indeed complicated, and, in closing, the following suggested explanation may be of interest. It is the author's opinion that when furnace treating, there are primarily two chemical reactions operating at one and the same time. The first consists of scale formation or a strictly oxidizing reaction. Throughout the work, regardless of the furnace atmosphere, the temperature or the length of time in the furnace, all sections showed a scaled surface after quenching. The author believes that this oxidization is so rapid in the early stages that it does not materially affect or change the composition of the carbides, but merely attacks the iron or parent metal. The carbides being soluble in the scale, eventually come into contact with the parent metal, which is in the austenitic condition, and, therefore, is capable of dissolving the carbides; consequently the carburization. In other words, the carburization is a direct result of scale. In the writer's opinion, this explains why the degree of carburization is somewhat greater in the neutral or oxidizing atmospheres than is found when reducing conditions are employed. This may be explained on the basis that the oxidizing atmospheres produce scale at a faster rate and to a greater degree than would be found with reducing atmospheres. If this carburization is dependent upon scale formation, then the type of scale will exert a definite influence. A loose, porous, flaky scale will permit the scaling reaction to continue for a longer time than will a tight, impervious scale.

The second reaction which takes place causes decarburization. It is generally conceded that decarburization may be caused by carbon dioxide, oxygen, moisture, hydrogen (moist) and some hydrocarbons under certain conditions. After a certain amount of scale is formed, the first or oxidizing reaction is materially slowed down, and when this occurs the decarburizing action becomes effective. This may be an explanation for the rapid carburization for short times and the decrease in the amount of carburization at longer times; finally, decarburization with still longer times. The same reason can be used to explain why a 10 per cent carbon monoxide atmosphere decarburizes this steel at 1900 deg. F., while as the temperature is raised, decarburization disappears, until finally at 2400 deg. F. there is extreme carburization. These conditions are related, in the author's opinion, to the degree of scaling, since as the temperature is increased, the rate of scaling materially increases.

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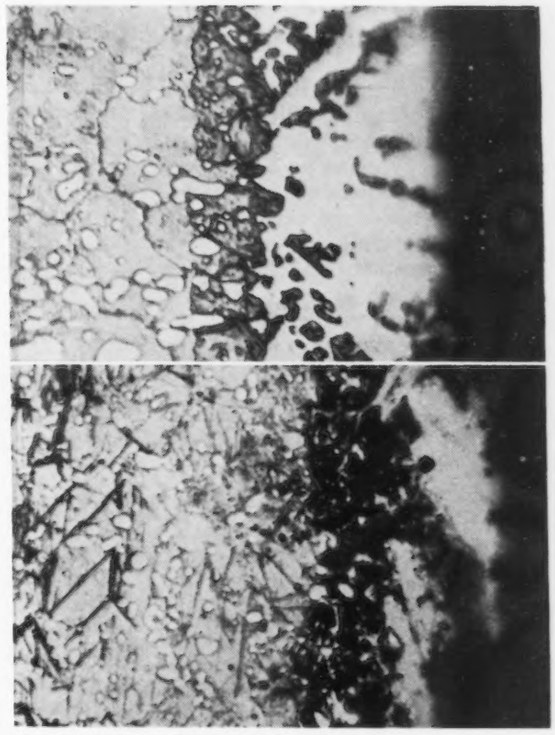

FIGS. 49 and 50—Microstructures of section treated from a carbon block. Fig. 49 (top)—Oil quenched from 2350 deg. F., from a carbon block, not drawn. Fig. 50 (bottom)—Oil quenched from 2350 deg. F., from a carbon block, drawn at 1050 deg. F. Both at 1000 diameters.

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The sections which were treated in the borax-boric acid bath also indicate that the carburization is related to the absorption of the carbides which were on the surface of the steel. It is a known fact that this type bath had a slight washing action and apparently when this washing action occurs, it affects the parent metal and not the carbides. These carbides eventually are absorbed by the austenitic matrix, resulting in carburization.

TABLE XV

Salt Bath Treating

Temperature, Deg. F.	Time, Min.	Borax-Boric Acid Bath, Carbon Step Down Tests			Barium Chloride Base Bath, Carbon Step Down Tests		
		Cut 1	Cut 2	Cut 3	Cut 1	Cut 2	Cut 3
2300	2	0.77	0.73	0.75	0.84	0.76	0.75
2300	6	0.85	0.78	0.77	0.80	0.73	0.72
2300	15	0.85	0.80	0.79	0.77	0.72	0.71
2350	2	0.81	0.75	0.72	0.83	0.75	0.74
2350	6	0.80	0.76	0.74	0.80	0.74	0.72
2350	15	0.81	0.79	0.78	0.82	0.72	0.72

Sections 1 in. round x 3 in. long. Surface carbon of machined bars = 0.73 per cent.

Treatments: Borax-boric acid:
Preheated 1600 deg. F., KCl-Na_2CO_3 bath.
Superheated, time at heat as indicated in table.
Quenched 1150 deg. F., KCl-Na_2CO_3 bath.
Barium chloride base bath:
Preheated 1500 deg. F., chloride base bath.
Superheated, time at heat indicated in table.
Quenched 1250 deg. F., NaCN base bath.

Cut 1 = 0.0000 to 0.0025 in. off surface.
Cut 2 = 0.0025 to 0.0050 in. off surface.
Cut 3 = 0.0050 to 0.0075 in. off surface.

Summary of Findings

When heating this steel for hardening, some metal-oxide zone invariably forms, regardless of the method of heating. When furnace treating, this zone can be held at a minimum by using an 8 to 12 per cent carbon monoxide atmosphere.

This steel does not carburize nor decarburize during the preheating when temperatures of 1500 to 1600 deg. F. are used.

This steel carburizes during the usual heat treating operations. The degree of carburization is related to the type of atmosphere. Unfortunately, the oxidizing atmospheres which produce the largest amounts of carburization *cannot* be used for the treating of the majority of tools made from this steel.

This study also indicates that this type of steel may be held at heat 10 min. in reducing atmospheres without causing decarburization.

Carburization, after studying both preheating and water quenching, must take place during the superheating operation.

The behavior of the carburized area during tempering is dependent upon the degree of carburization, resulting in a structure which has a high percentage of retained austenite. Under normal heat treating conditions, the retained austenite found in the carburized zone may be decomposed into martensite by re-tempering.

The two types of salt baths employed in this work showed that this steel will carburize when treated from these media.

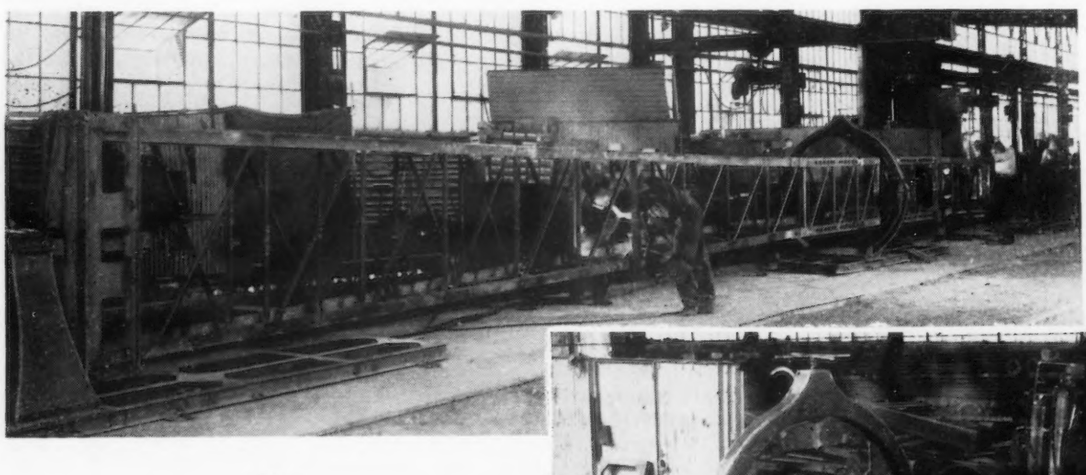
It is the author's belief that the carburization found is related to scaling when furnace treating, or to the washing action of the salt when salt baths are used.

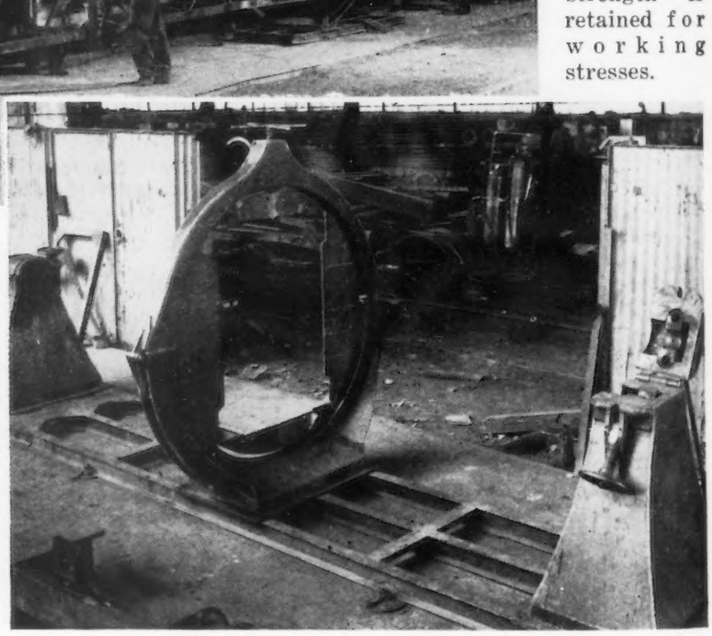
Welding Jig for Long Structures

WELDING of structural crane booms from 25 to 85 ft. in length and plate section shovel booms from 16 to 35 ft. long has been greatly facilitated at the plant of the Osgood Co., Marion, Ohio, through the use of a revolving type welding jig. The positioner, which has been in successful use for over 18 months, was devised by Harry J. Hibbett, general foreman of the welding and structural shop of the firm, which is a builder of power excavating and material handling machinery.

In this device the crane structure is supported at both ends by trunnion attachments and in the middle by a revolving fabricated support which has an opening that may be either round, rectangular or triangular. This center section is supported on three rollers, the topmost one of which can be screwed down to hold the assembly in any position. The end trunnion bearings which are carried in high pedestals of welded plate construction permit expansion and contraction of the structure during welding and the whole rig maintains alinement of the work in any position.

In welding one of the structural booms, the pipe lacing with flattened ends is first tack welded in place. Then the entire structure is welded in the center in both directions, revolving the boom to permit all downhand welding. This method avoids locking up any residual strains during welding and since no straightening is required later, a major portion of the metal strength is retained for working stresses.





ABOVE

AN 80-ft. dragline boom in production in the revolving type jig. This equipment assures perfect alinement of the finished product and enables all welds to be made in a down-hand position.

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RIGHT

THE basic jig, showing the center revolving section with rectangular opening. This opening may also be triangular or circular in cross-section.

Specification Plating

Nine methods of checking deposit thickness, as well as tables of various metals for estimating the time necessary to produce given deposits at various known current densities are shown in this last article on specification plating.

By C. B. F. YOUNG
Head of the Institute of Electrochemistry and Metallurgy
Brooklyn Polytechnic Institute
and
Consultant, New York

THE remaining subject concerning specification plating to be discussed is the methods employed to check deposit thicknesses to determine whether the correct amount of metal has actually been deposited. There are nine methods of determining the thicknesses of metal plate:

Microscope	**Magnet**
Measle Chord	**Drop test**
Micrometer	**Jet test**
Induction	**Spot test**
Chemical Strip	

The *microscope* method is one of the most accurate methods of checking plate thickness, because the actual thickness is observed through a microscope with an eyepiece that is calibrated so that the exact measurement can be obtained. In order to accomplish this, a section of the object that has been plated is cut perpendicular to the deposit in order to get a true thickness. After cutting, the article is then mounted in a low-melting alloy, bakelite, or some similar substance, and polished and etched. The sample is then placed under the microscope and brought into focus. If the microscope is equipped with a micrometer eyepiece, it is very simple to obtain a direct reading of the thickness of the deposit. This is a good method to use provided there are large amounts of work to be plated. In order to obtain thicknesses by this method the following equipment is necessary: microscope, light source, micrometer eye piece, polishing papers, holders, and mountings. Also, a bit of practice is essential in obtaining good results. All parts being tested are destroyed by this method.

The *measle chord* method depends upon filing a curved surface until the base metal is exposed and then measuring the length of the file mark. If the object to be measured is flat, a precision grinding wheel is used until the base metal is reached and the length of the grind mark is measured. In either case the thickness can be obtained by substituting in the following formula:

$$\text{Thickness} = \frac{C^2}{8R}$$

where; C is the length of cut
R is the radius of the grinding wheel or the object.

R can be measured directly in the case of the grinding wheel and can be determined rather easily in the other case by simply measuring the factor, using a small instrument known as a spherometer, which measures the radius of curvature of curved surfaces. The diagrams in Fig. 2 will illustrate the method in each case.

This method requires a precision grinding wheel, file, scale magnifying glass, and a spherometer, which are all inexpensive and easy to handle, and the time necessary to obtain a thickness is comparatively short. The object that is used is not destroyed, but the coating is ruined. This can be stripped off, however, and the object refinished. The method is not as accurate as the microscopic method, but it will give results that are suitable for most electroplating departments.

The *micrometer method* consists of either obtaining the thickness of several pieces before plating and then depositing the plate upon their surfaces and then checking them again for their thickness, or, first applying the plate and obtaining the thickness by the micrometer and then stripping the deposit and rechecking the thickness. The first is the reverse of the second, and both depend upon the difference between two readings. This type is easy to apply, but the surface must be flat or nearly so for the best results. This does not work well for very thin deposits, as the error is too great. Care must be exercised when the deposit is dissolved, lest the base metal be attacked, and a large error be introduced which will show too great a thickness. This method is inexpensive, as only a micrometer is used and no special technique is needed. However, it is not too accurate and does not work well on all shapes. The work is not destroyed by this method.

The *induction method* of calculating deposit thickness was orig-

inally developed for the organic or non-conductive coating, but it can, however, be calibrated to indicate the thicknesses of metallic coatings. This apparatus necessarily consists of a coil of wire wound around a laminated steel core which is closed on all sides except one. The coil is connected to a source of current and a galvanometer that is enlarged by an amplifying system. The current flowing through the coil is measured by a sensitive galvanometer and change in the flow is registered immediately. The electrical circuit is closed and the flow of current through it can be varied in only one way; by changing the magnetic flux, which can be done very easily by closing the steel core. This is done by bringing the open side of the lamination near a metallic body such as steel. When such a body is brought near, a definite deflection occurs. If the steel is covered with zinc, cadmium, brass, etc., the coating insulates the steel base from the laminated core, which in turn affects the deflection of the galvanometer. This deflection depends upon the thickness of deposit.

TABLE III

Base Metal	Plate	Base Metal	Plate
Copper	Nickel, Chromium, Zinc, Cadmium, Tin, Silver, Brass, Gold	Steel	Copper, Nickel, Chromium, Tin, Silver, Zinc, Cadmium, Brass
Tin or Lead alloys	Copper, Nickel, Chromium, Silver, Brass	Nickel-Silver	Copper, Nickel, Chromium, Silver, Brass
Brass	Copper, Nickel, Chromium, Tin, Zinc, Cadmium, Silver, Gold	Zinc or zinc base die castings	Copper, Nickel, Chromium, Brass, Silver

The *drop test method* uses a standard solution which is dropped on the article to be tested at the rate of 80 to 120 drops per min. until the deposit is dissolved by the chemical action of the solution and exposes the base metal. The time, in seconds, required to accomplish this is noted, each second being equivalent to 0.00001 in. deposit thickness.

This method was developed primarily for zinc and cadmium coatings on steel, but undoubtedly it will be adapted to other metals in the future. The following are standard baths:

Zinc:
- Ammonium nitrate (NH_4NO_3) — 100 gm. per l. — 13.33 oz. per gal.
- Nitric acid, conc. (HNO_3) — 75 gm. per l. — 10 oz. per gal.

Cadmium:
- Ammonium nitrate (NH_4NO_3) — 110 gm. per l. — 14.67 oz. per gal.
- Hydrochloric acid, conc. (HCl) — 13.7 gm. per l. — 1.83 oz. per gal.

The drop method has the advantage of being cheap to install and operate. Its accuracy is good enough for the average shop plating zinc and cadmium, and the object is not destroyed, and after testing can be refinished. The method, however, is limited to zinc and cadmium deposited upon steel.

The *jet method*, developed for the more resistant metals, uses a steady stream of the solution instead of drops. It has been applied to copper, nickel, bronze, cadmium and zinc with good results. However, it is not in general use at the present time. In principle, it consists of a steady stream impinging on the plated surface instead of successive drops, and coatings of commercial thicknesses require one to two min. for penetration. The accuracy is in the neighborhood of 15 per cent. Only the coating is destroyed and the object can be replated with very little trouble.

The apparatus necessary consists of a burette having a capacity of 100 cc. The orifice should be adjusted so 10 cc. of water passes through in 30 sec. A reservoir bottle is connected so that a constant head of liquid is maintained at all times so that a constant volume will flow throughout the test. The surface to be tested must be free of grease and chromium. The former can be removed by scrubbing with powdered magnesium

TABLE IV

No.	Base Metal	Metal to be Stripped	Stripping Solution	Specific Gravity	Solution Concentration Per Cent	Conditions
1	Copper	Chromium	Hydrochloric Acid	1.19	50	68 deg. F
2	Copper	Nickel	Sulphuric Acid	1.84	50	.....
			Nitric Acid	1.42	50	185 deg. F.
3	Copper	Zinc	Hydrochloric Acid	1.19	10	68 deg. F.
4	Copper	Cadmium	Hydrochloric Acid	1.19	10	68 deg. F.
5	Copper	Tin	Hydrochloric Acid	1.19	5	Anode, emf.
			Water	....	95	= 6v.
6	Copper	Silver	Sulphuric Acid	1.84	95	176 deg. F.
			Nitric Acid	1.42	5	.....
7	Copper	Brass	Not used	....	....	.....
8	Copper	Gold	Nitric Acid	1.42	66	68 deg. F.
			Hydrochloric Acid	1.19	34	.....
9	Brass	Copper	No good method	....	....	.....
11	Brass	Chromium	Hydrochloric Acid	1.19	50	68 deg. F.
			Water	....	50	.....
10	Brass	Nickel	Same as No. 2	....	....	.....
12	Brass	Tin	Same as No. 11	....	....	.....
13	Brass	Zinc	Same as No. 3	....	....	.....
14	Brass	Cadmium	Same as No. 3	....	....	.....
15	Brass	Silver	Same as No. 6	....	....	.....
16	Brass	Gold	Same as No. 8	....	....	.....
17	Nickel-Silver	Copper	NaCN, 10 oz. per gal.	....	....	68 deg. F.
18	Nickel-Silver	Nickel	Same as No. 2	....	....	.....
19	Nickel-Silver	Chromium	Same as No. 11	....	....	.....
20	Nickel-Silver	Silver	Same as No. 6	....	....	.....
21	Nickel-Silver	Brass	Same as No. 17	....	....	.....
22	Tin or Lead Alloy	Copper	Same as No. 17	....	....	.....
23	Tin or Lead Alloy	Nickel	Same as No. 5	....	....	.....
24	Tin or Lead Alloy	Chromium	Same as No. 1	....	....	.....
25	Tin or Lead Alloy	Silver	NaCN, 5 oz. per gal.	....	....	Anode, 10 amp. per sq. ft.
26	Tin or Lead Alloy	Brass	Same as No. 17	....	....	.....
27	Zinc; Alloys	Copper	Dissolve base metal in solution of caustic soda (NaOH), 100 gm. per l., which leaves deposit.			
28	Zinc; Alloys	Nickel	Sulphuric Acid	1.84	99	.....
			Glycerin	....	1	Anode
29	Zinc; Alloys	Chromium	Same as No. 28	....	....	.....
30	Zinc; Alloys	Brass	Dissolve in concentrated hydrochloric acid, and analyze for copper, which is 70 per cent of coating.			
31	Zinc; Alloys	Silver	Same as No. 27	....	....	.....

oxide on a damp cloth and then drying with a clean cloth. The chromium can be dissolved by immersing the object in hydrochloric acid of 1.16 specific gravity containing 2 per cent antimonious oxide and operated at room temperature.

The article to be tested is clamped about ¼ in. below the jet at a 45-deg. angle. The stream of liquid and a stop watch are started simultaneously and allowed to proceed for 5 to 10 sec., and then the spot is examined. This is repeated without removing the last piece until penetration below the jet is observed. The actual time required to accomplish this is compared to the actual time necessary for the same solution to penetrate the same coating 0.001 in. thick. Care must be taken to see that the test piece is run at the same temperature as the standard piece.

The solutions used will depend upon the coating being tested. For nickel a solution containing ferric chloride, cupric sulfate and acetic acid is used, and at 68 deg. F., 0.0001 in. is removed in 11 sec.

Ferric chloride ($FeCl_3 6H_2O$)	100 gm. per l.	13.33 oz. per gal.
Cupric sulfate ($CuSO_5 5H_2O$)	250 gm. per l.	33.44 oz. per gal.
Acetic acid ($HC_2H_3O_2$) glacial	250 cc. per l.	35.41 oz. per gal.

Ferric chloride is the principal solvent. The copper salt produces a coppered spot on some metals at the point of perforation after the flow has stopped, allowing excess solution to flow away. The acetic acid prevents localized action at pores on anodic metals like steel.

This solution can also be used for copper deposits on steel. This type of test can be used for zinc and cadmium, and a solution is used similar to that employed in the drop test, except that it is less concentrated due to the more rapid attack on these metals. All solutions are standardized by determining the time of flow required to perforate a unit of thickness of deposit.

The *spot test* finds adaptation in the determination of thin chromium deposits that are not thick enough to be determined with the microscope or the chord method. The test consists of placing a drop of concentrated hydrochloric acid upon the deposit of chromium and timing the period of gassing. At 70 deg. F., each second is equivalent to 0.000001 in. This method depends upon the chromium going into solution, and for this reason the surface of the metal must be clean and in the active state. If the metal is either dirty or in the passive state the chromium will not react as readily and, therefore, give a result that will be too high. It is best to make the article the cathode in an electro-cleaner for a few minutes prior to testing for thickness. This method has the advantage of being extremely simple and having an accuracy within reason. Care must be taken to see that the surface is clean before running the test.

We come now to the *chemical strip method*, generally conceded to be the standard method. It is accurate, but also time consuming, and a technique is required. The method may be modified so that it is very similar to the micrometer method, in that the thickness of

TABLE V

GOLD AU+

Electrochemical equivalent = 0.0020436
Density = 19.32
Weight = $0.00254 \times 6.4432 \times 144 \times 19.32 = 45.51$ gm.

$$\frac{45.51}{1 \times .0020436} = 22{,}221 \text{ sec.} = 370 \text{ min.} = 6.20 \text{ hr.}$$

C. D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.0010	0.002	0.003
1	*37	**1-14	1-51	2-28	3-5	3-42	4-19	4-56	5-32	6-10	12-20	18-30
5	7	15	22	30	37	44	52	59	1-7	1-14	2-28	3-42
10	4	7	11	15	18	22	26	30	33	37	1-14	1-51
15	2	5	7	10	12	15	17	20	22	25	50	1-14
20	2	4	6	7	9	11	13	15	17	19	37	56
25	1	3	4	6	7	9	10	12	13	14	30	44
30	1	2	4	5	6	7	9	10	11	12	24	36
35	1	2	3	4	5	6	7	8	9	11	22	33
40	1	2	3	4	5	6	6	7	8	9	18	27
45	0.8	2	2	4	4	5	6	6	7	8	16	25
50	0.7	1	2	3	4	4	5	6	7	7	15	22
gm. per sq. ft.	4.55	9.12	13.62	18.20	22.70	27.22	31.80	36.40	41.00	45.51	91.02	136.53
Avoir. oz. per sq. ft.	0.16	0.32	0.48	0.64	0.80	0.96	1.12	1.28	1.44	1.60	3.20	4.80
Troy oz. per sq. ft.	0.15	0.29	0.44	0.59	0.73	.088	1.02	1.17	1.32	1.47	2.94	4.40
$ gold† per sq. ft.	5.25	10.15	15.40	20.62	25.28	30.80	35.70	41.00	46.20	51.49	102.98	154.47

† All figures based on the cost of gold at $35.00 per troy oz.
* read, 37 min.
** read, 1 hr. 14 min.

TABLE VI

GOLD AU+++

Electrochemical equivalent = 0.0006812
Density = 19.32
Weight = $0.00254 \times 6.4432 \times 144 \times 19.32 = 45.51$ gm.

$$\frac{45.51}{1 \times 0.006812} = 66{,}980 \text{ sec.} = 1118 \text{ min.} = 18.6 \text{ hr.}$$

C. D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.0010	0.002	0.003
1	*1-52	3-43	5-35	7-27	9-15	11-11	13-2	14-54	16-48	18-38	37-16	55-54
5	22	45	1-7	1-29	1-52	2-18	2-36	2-58	3-20	3-44	7-27	11-10
10	11	22	34	45	56	1-7	1-18	1-30	1-41	1-52	2-44	5-36
15	7	15	22	30	37	45	52	1	1-7	1-15	2-30	3-45
20	6	11	17	22	28	34	39	45	50	56	1-52	2-48
25	4	9	13	18	22	27	31	36	40	45	1-29	2-14
30	4	8	11	15	19	23	27	31	34	38	1-16	1-53
35	3	6	10	13	16	19	22	26	29	32	1-4	1-36
40	3	6	8	11	14	17	20	22	25	28	56	1-24
45	2	5	7	10	12	15	17	20	22	25	50	1-14
50	2	4	7	9	11	13	16	18	20	22	45	1-7
gm. per sq. ft.	4.55	9.12	13.62	18.20	22.70	27.22	31.80	36.40	41.00	45.51	91.02	136.53
Avoir. oz. per sq. ft.	0.16	0.32	0.48	0.64	0.80	0.96	1.12	1.28	1.44	1.60	3.20	4.80
Troy oz. per sq. ft.	0.15	0.29	0.44	0.59	0.73	0.88	1.02	1.17	1.32	1.47	2.94	4.40
$ gold per sq. ft.	5.25	10.15	15.40	20.62	25.28	30.80	35.70	41.00	46.20	51.49	102.98	154.47

* read, 1 hr. 52 min.

TABLE VII

Zn++ 0.000339 × 30 per cent = 0.0001017
Cu+ 0.0006588 × 70 per cent = 0.0004612

BRASS 70-30

Electrochemical equivalent 0.0005629
Density = 8.5
Weight = 0.00254 × 929.988 × 8.5 = 20.02 gm.

$$\frac{20.02}{0.005629} = 35{,}580 \text{ sec.} = 593 \text{ min.} = 9.88 \text{ hr.}$$

C. D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.0010	0.002	0.003
1	59	*1-59	2-58	3-57	4-56	5-55	6-55	7-54	8-54	9-53	19-46	29-39
5	12	24	36	47	59	1-11	1-23	1-35	1-47	1-59	3-57	5-56
10	6	12	18	24	30	36	42	47	53	59	1-59	2-58
15	4	8	12	16	20	24	28	32	36	40	1-20	1-59
20	3	6	9	12	15	18	21	24	27	30	1-0	1-29
25	2	5	7	9	12	14	17	19	21	24	47	1-11
30	2	4	6	8	10	12	14	16	18	20	40	59
35	2	3	5	7	9	10	12	14	15	17	34	51
40	1	3	4	6	7	9	10	12	13	15	30	45
45	1	3	4	5	7	8	9	10	12	13	26	39
50	1	2	4	5	6	7	8	9	11	12	23	35
gm. per sq. ft.	2.00	4.00	6.00	8.00	10.01	12.01	14.01	16.02	18.02	20.02	40.04	60.06
oz. per sq. ft.	0.07	0.14	0.21	0.28	4.35	0.42	0.49	0.57	0.64	0.71	1.42	2.11

* read, 1 hr. 59 min.

TABLE VIII

Electrochemical equivalent = 0.001118 gm. per coulomb.
Density = 10.50.

SILVER Ag+

Weight = 0.00254 x 929.088 x 10.50 = 24.78 gm.
24.78 divided by 0.001118 = 22920 sec. = 382 min. = 6.2 hr.

C. D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	38	*1-16	1-54	2-33	3-11	3-49	4-27	5- 5	5-44	6-22	12-44	19- 6
5	8	15	23	30	38	46	53	1- 1	1- 9	1-16	2-35	2-48
10	4	8	11	15	19	23	27	30	34	38	1-16	1-55
15	3	5	8	11	13	15	18	20	23	25	51	1-16
20	2	4	6	8	10	11	13	15	17	19	38	57
25	2	3	5	6	8	9	11	12	14	15	31	46
30	1	3	4	5	6	8	9	10	11	12	25	38
35	1	2	3	4	6	7	8	9	10	11	22	34
40	1	2	3	4	5	6	7	8	9	10	19	29
45	1	2	3	3	4	5	6	7	8	9	17	25
50	1	2	2	3	4	5	5	6	7	8	15	23
gm. per sq. ft.	2.48	4.95	7.42	9.90	12.38	14.82	17.30	19.80	22.22	24.78	49.50	74.20
oz. per sq. ft.	0.09	0.18	0.26	3.50	0.43	0.53	0.61	0.70	0.79	0.87	1.75	2.62

* read, 1 hr. 16 min.

TABLE IX

Electrochemical equivalent = 0.0006166 gm. per coulomb.
Density = 7.3.

TIN Sn++

Weight = 0.00254 x 929.088 x 7.3 = 17.20 gm.
17.20 divided by 0.0006166 = 2791 sec. = 464 min. = 7.74 hr.

C. D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	46	*1-33	2-19	3- 5	3-51	4-38	5-24	6-10	6-57	7-44	15-28	23-12
5	9	19	28	37	46	56	1- 5	1-14	1-24	1-33	3- 5	4-38
10	5	9	14	19	23	28	32	37	42	46	1-33	2-18
15	3	6	9	12	15	19	22	25	28	31	1- 2	1-33
20	2	5	7	9	12	14	16	19	21	23	46	1-10
25	2	4	6	7	9	11	13	15	17	19	37	56
30	2	3	5	6	8	9	11	12	14	15	31	47
35	1	3	4	5	7	8	9	11	12	13	26	40
40	1	2	3	5	6	7	8	9	10	12	23	35
45	1	2	3	4	5	6	7	8	9	10	20	31
50	1	2	3	4	5	6	7	7	8	9	18	28
gm. per sq. ft.	1.72	3.44	5.16	6.88	8.60	10.32	12.03	13.75	15.49	17.20	34.40	51.60
oz. per sq. ft.	0.061	0.121	0.18	0.24	0.30	0.37	0.43	0.49	0.55	0.61	1.21	1.82

* read, 1 hr. 33 min.

material is determined with a micrometer and then stripped. The thickness is again taken and the difference is the thickness of the coating.

Also the weight of the object can be taken before plating and then the deposit applied. It is then reweighed and the difference is the weight of the deposit. From this the thickness can be calculated, provided the density of the plate is known. However, the best method of checking the thickness is to strip off the deposit in a solution of known volume and then determine the amount of the deposit in the stripping agent by chemical means. Again the thickness of the deposit can be calculated from the weight provided the density is known.

For example, the plate thickness of a silver plated hollow ware object is desired. A solution of sulphuric and nitric acid is used to strip off the silver. Exactly four liters of the stripping solution are used. After stripping, 25 cc. of this solution is analyzed for silver by titrating with a standard sodium chloride solution using potassium chromate as an indicator. It is found that 0.5 gm. of silver is present in the 25 cc. Now in the original bath there were four liters or 4000 cc. So, if 25 cc. contains 0.5 gm., 4000 cc. contains 80 gm. of silver. The density of silver is 10.6. Now the weight of material occupying space may be calculated as follows:

(Area = 5 × 5 cm.)

Weight = length × width × thickness × density, or

Weight = L × W × T × D

In this case we know the weight, Wt., and desire the thickness, T. This, from the mathematical angle:

$$T = \frac{\text{Wt.}}{L \times W \times D} = \frac{\text{Wt.}}{L \times W \times 10.6}$$

$$\text{thickness in cm.} = \frac{\text{Wt. of deposit in gm.}}{\text{Area in sq. cm.} \times 10.6}$$

This may be further simplified by dividing 10.6 into 1

Thus, $\frac{1}{10.6} = 0.0943$ and

$$\text{Thickness in cm.} = \frac{\text{Wt. of deposit in gm.} \times 0.0943}{\text{Area in sq. cm.}}$$

$$= \frac{80 \times 0.0943}{25} = 0.302 \text{ cm.}$$

By substituting the density of a metal, it is possible to obtain a formula such as the one above for any metal or alloy. Thus, for

nickel, with a density of 8.75, we have:

$$T = \frac{\text{Wt. of deposit}}{\text{Area} \times 8.75} \text{ or } \frac{\text{Wt.} \times 0.114}{\text{Area}}$$

A thickness indicator, recently developed at the Bureau of Standards, is finding application in the industry for testing nickel deposits on non-magnetic base metals such as brass. The nickel, being magnetic, will exert a pull on the magnet, which pull is directly proportional to the thickness of the deposit. One method applying the test is to suspend the magnet to a spring attached to a dial. The magnet is placed on the nickel coating and the pull necessary to overcome the attraction of the magnet to the coating is produced by turning the dial. When the magnet breaks away the reading is obtained, and, by calibrating the scale, the thickness can be obtained. The apparatus as built is expensive, but results are obtained quickly, and the coating is not injured in any way.

The base metals that are generally utilized in the metal working field are copper, brass, nickel, silver, tin and/or lead alloys, zinc and zinc base die castings, and steel. There are other metals and alloys used to some extent such as aluminum, magnesium, etc., but the above list covers most of the field.

The coatings generally used in covering the above are copper, nickel, chromium, tin, silver, zinc, cadmium, brass and gold. Now and then other metals such as lead, cobalt, platinum, etc., are used but such practice is not general.

The base metals with the coatings that are mostly used are shown in Table III. It must be kept in mind that several coatings can be used on one base. For instance, steel may have nickel, copper, and chromium as a finish.

A method is presented in Table IV whereby the coatings shown in Table III may be separated from the base metal and determined. This is not a complete treatment of the subject, but it will give a method to employ in each case and also point the way for experimentation if so desired.

Tables V to XVII were prepared specifically for estimating the time necessary to produce a given deposit at a known current density. In each table, with the exception of Table XV, for chromium the following current densities are used: 1, 5, 10, 15, 20, 25, 30, 35, 40, 45, and 50 amp. per sq. ft. For chromium, in Table XV, the following current

TABLE X

Electrochemical equivalent = 0.0003083 gm. per coulomb.
Density = 7.3.
TIN Sn++++ Weight = 0.00254 x 929.088 x 7.3 = 17.20 gm.
17.20 divided by 0.0003083 = 5582 sec. = 928 min. = 15.48 hr.

C. D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	*1-33	3- 6	4-39	6-12	7-45	9-18	10-51	12-24	13-57	15-28	30-56	46-24
5	19	37	55	1-14	1-33	1-51	2- 9	2-28	2-46	3- 5	6-11	9-17
10	9	19	28	37	46	56	1- 5	1-14	1-24	1-33	3- 5	4-38
15	6	12	19	25	31	38	44	50	57	1- 3	2- 5	3- 8
20	5	9	14	19	23	28	32	37	42	46	1-33	2-19
25	4	7	11	15	19	22	26	30	33	37	1-14	1-51
30	3	6	9	12	15	19	22	25	28	31	1- 2	1-33
35	3	5	8	11	13	16	19	21	24	26	53	1-20
40	2	5	7	9	12	14	16	19	21	23	46	1-10
45	2	4	6	8	10	12	14	17	19	21	41	1- 2
50	2	4	6	7	9	11	13	15	17	19	37	56
gm. per sq. ft.	1.72	3.44	5.16	6.88	8.60	10.32	12.03	13.75	15.49	17.20	34.40	51.60
oz. per sq. ft.	0.06	0.12	0.18	0.24	0.30	0.37	0.43	0.49	0.55	0.61	1.21	1.82

* read, 1 hr. 33 min.

TABLE XI

Electrochemical equivalent = 0.000339 gm. per coulomb.
Density = 7.1.
ZINC Zn++ Weight = 0.00254 x 929.088 x 7.1 = 16.72 gm.
16.72 divided by 0.000339 = 49200 sec. = 820 min. = 13.6 hr.

C. D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	*1-22	2-44	4- 6	5-28	6-50	8-18	9-34	10-56	12-18	13-40	27-20	41
5	16.4	33	49	1- 6	1-22	1-38	1-54	2-12	2-27	2-44	5-28	8-12
10	8.2	16	24	32	41	49	57	1- 5	1-13	1-22	2-44	5-28
15	5.5	11	16	22	27	33	38	44	49	55	1-50	2-45
20	4	8	12	16	20	25	29	33	37	41	1-22	2- 3
25	3.3	7	10	13	17	20	23	26	29	32	1- 5	2-10
30	2.7	5	8	11	14	16	19	22	24	27	54	1-21
35	2.3	4	7	9	11	14	16	18	21	23	46	1- 9
40	2	4	6	8	10	12	14	16	18	20	41	1- 2
45	1.8	4	5	7	9	11	13	14	16	18	36	55
50	1.6	3	5	6	8	10	11	13	14	16	33	49
gm. per sq. ft.	1.67	3.34	5.01	6.7	8.35	10.03	11.70	13.38	15.02	16.72	33.44	50 16
oz. per sq. ft.	0.059	0.188	0.177	0.236	0.295	0.354	0.413	0.472	0.531	0.590	1.180	1.770

* read, 1 hr. 22 min.

TABLE XII

Electrochemical equivalent = 0.0005824 grams per coulomb.
Density = 8.65.
CADMIUM Cd++ Weight = 0.00254 x 929.088 x 8.65 = 20.19 gm.
20.19 divided by 0.0005824 = 34999 sec. = 582 min. = 9.7 hr.

C. D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	58	*1-56	2-54	3-52	4-50	5-48	6-46	7-44	8-42	9-40	19-20	29- 0
5	12	23	35	46	58	1-10	1-21	1-33	1-44	1-56	3-52	5-48
10	6	12	17	23	29	35	41	46	52	58	1-56	2-54
15	4	8	12	16	20	23	27	31	35	39	1-18	1-57
20	3	6	9	12	15	18	21	23	26	29	38	1-27
25	2	5	7	9	11	14	16	18	21	23	47	1-10
30	2	4	6	8	10	12	14	16	17	19	39	58
35	2	3	5	7	8	10	12	13	15	16	33	42
40	1	3	4	6	7	9	10	12	13	15	29	44
45	1	3	4	5	7	8	9	10	12	13	26	39
50	1	2	3	5	6	7	8	9	10	11	23	34
gm. per sq. ft.	2.02	4.04	6.06	8.08	10.10	12.12	14.14	16.16	18.18	20.19	40.38	60.57
oz. per sq. ft.	0.07	0.14	0.21	0.29	0.36	0.43	0.50	0.57	0.64	0.71	1.42	2.13

* read, 1 hr. 56 min.

TABLE XIII

COPPER Cu+

Electrochemical equivalent = 0.0006588.
Density = 8.93.
Weight = 0.00245 x 929.088 x 8.93 = 21.00 gm.
21.00 divided by 0.0006588 = 31,990 sec. = 534 min. = 8.9 hr.

C. D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	53	*1-47	2-41	3-35	4-29	5-22	6-16	7-10	8- 4	8-54	17-49	26-42
5	11	21	32	43	54	1- 4	1-15	1-26	1-36	1-47	3-34	5-21
10	5	11	16	22	27	32	38	43	49	54	1-48	2-42
15	4	7	11	14	18	21	25	28	32	36	1-12	1-48
20	3	5	8	11	13	16	19	21	24	27	54	1-21
25	2	4	6	9	11	13	15	17	19	21	43	1- 3
30	2	4	5	7	9	11	12	14	16	18	36	54
35	2	3	5	6	8	9	11	12	14	15	30	46
40	2	3	4	5	7	8	9	11	12	13	26	40
45	1	2	4	5	6	7	8	9	11	12	23	35
50	1	2	3	4	5	6	7	9	10	11	21	32
gm. per sq. ft.	2.10	4.20	6.30	8.40	10.50	12.60	14.70	16.80	18.90	21.00	42.00	63.00
oz. per sq. ft.	0.07	0.15	0.22	0.29	0.40	0.44	0.51	0.59	0.66	0.74	2.20	2.22

* read, 1 hr. 47 min.

TABLE XIV

COPPER Cu++

Electrochemical equivalent = 0.0003294 gm. per coulomb.
Density = 8.93.
Weight = 0.00254 x 929.088 x 8.93 = 21.00 gm.
21.00 divided by 0.0003294 = 63,980 sec. = 1068 min. = 17.8 hr.

C. D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	*1-47	3-34	5-21	7- 8	8-55	10-44	12-30	14-15	16- 2	17-48	35-36	53-24
5	21	42	1- 4	1-25	1-47	2- 8	2-29	2-50	3-12	3-34	7- 8	10-42
10	11	21	32	43	53	1- 4	1-15	1-26	1-36	1-47	3-34	5-21
15	7	14	21	28	36	43	50	57	1- 4	1-11	2-22	3-33
20	5	11	16	21	27	32	37	43	48	53	1-47	2-40
25	4	9	13	17	21	26	30	34	39	43	1-26	2- 9
30	4	8	11	14	18	21	25	29	32	36	1-12	1-48
35	3	6	9	12	15	18	21	24	28	31	1- 2	1-31
40	3	5	8	11	13	16	19	21	24	27	54	1-21
45	2	5	7	10	12	14	17	19	21	24	48	1-12
50	2	4	6	9	11	13	15	17	19	21	43	1- 4
gm. per sq. ft.	2.10	4.20	6.30	8.40	10.50	12.60	14.70	16.80	18.90	21.00	42.00	63.00
oz. per sq. ft.	0.07	0.15	0.22	0.29	0.40	0.44	0.51	0.59	0.66	0.74	1.47	2.20

* read, 1 hr. 47 min.

TABLE XV

CHROMIUM 6+

Electrochemical equivalent = 0.0000898.
Density = 6.92.
Weight = 0.00254 x 929.088 x 6.92 = 16.32 gm.
16.32 divided by 0.0000898 = 181998 sec. = 3033 min. = 50.5 hr.

C. D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	*5- 4	10- 8	15-12	20-16	25-20	30-24	35-28	40-32	45-36	50-36	101-12	151-48
5	1- 1	2- 2	3- 2	4- 3	5- 5	6- 6	7- 7	8- 8	9- 9	10- 9	20-18	30-27
10	31	1- 2	1-33	2- 4	2-35	3- 6	3-37	4- 8	4-39	5- 4	10- 8	15-12
15	20	40	1- 1	1-21	1-42	2- 1	2-22	2-42	3- 2	3-22	6-44	10- 6
20	15	30	45	1- 0	1-16	1-31	1-46	2-1	2- 1	2-32	5- 4	7-36
25	12	24	36	49	1- 1	1-13	1-25	1-37	1-49	2- 1	4- 3	6- 4
30	10	20	30	40	51	1- 1	1-11	1-21	1-31	1-41	3-22	5- 3
50	6	12	18	24	31	37	43	49	55	1	2	3
75	4	8	12	16	20	24	28	32	36	40	1-21	2- 1
100	3	6	9	12	15	18	21	24	26	30	1- 1	1-31
150	2	4	6	8	10	12	14	16	18	20	40	1-21
175	2	3	5	7	9	10	12	14	15	17	35	52
200	2	3	5	6	8	9	11	12	14	15	30	46
gm. per sq. ft.	1.63	3.26	4.88	6.51	8.15	9.76	11.40	13.01	14.65	16.32	32.64	48.92
oz. per sq. ft.	0.058	0.12	0.17	0.23	0.29	0.35	0.40	0.46	0.52	0.58	1.15	1.73

* read, 5 hr. 4 min.

densities are used: 1, 5, 10, 15, 20, 25, 30, 50, 75, 100, 150, 175, and 200 amp. per sq. ft. In all cases the following thicknesses are used: 0.0001, 0.0002, 0.0003, 0.0004, 0.0005, 0.0006, 0.0007, 0.0008, 0.0009, 0.001, 0.002, and 0.003 in. At the bottom of each compilation the gm. of metal per sq. ft. and oz. of metal per sq. ft. are given for each thickness. The amount of gold per unit area is given in avoir. oz. per sq. ft., troy oz. per sq. ft. and also dollar value of gold per sq. ft. This tabulation was made because of the high value of the product under consideration.

Table VII was calculated for brass, making, of course, certain assumptions. A 70 per cent copper, 30 per cent zinc alloy was selected. The electrochemical equivalent was calculated by taking 70 per cent of the electrochemical equivalent of copper and adding to it 30 per cent of the electrochemical equivalent of zinc. This gives a value of 0.0005629 gm. per coulomb as the electrochemical equivalent of brass. The density was calculated in the same manner. Table VII will serve as a guide in brass plating.

The calculation of each table is based upon the fact that, for a given thickness, a definite amount of metal will be deposited per unit area. This amount can be determined if the density is known. In all cases the weight of metal which occupies the space of 0.000083 cu. ft. (1x1x0.000083) was found. Instead of using cubic feet, cubic centimeters were found more practical. Thus for zinc, in Table XI:

Weight of metal = Length × Width × Thickness × Density

or; weight of metal = 0.00254 cm. × 6.4432 × 144 × 7.1 = 16.74 gm.
0.001 in. × 1 in. × 1 in. × 144

Now, weight of metal deposited = Current (C) × Time (T) × Electrochemical Equivalent, (Z) or,

$$Wt. = CTZ$$

Assume the current to be one amp. per sq. ft.

Z for Zinc = 0.000339

$$T = \frac{Wt.}{CZ} = \frac{16.74}{1 \times 0.000339} = 49380 \text{ sec.},$$

or 823 min., or 13 hr. and 43 min.

Thus, for one sq. ft. of surface, it will require one amp. 13.6 hr. to deposit a layer of zinc 0.001 in. thick. All other determinations are based on this information.

Here, it must be pointed out that the above figures are based on a cathode efficiency of 100 per cent.

That is, all the current passing from the solution to the cathode reduces the theoretical amount of metal. For every 96,483.7 coulombs of electricity passing through the cell, one equivalent weight of metal will be reduced. This is not true in most cases, however, as has been pointed out above. Generally, the best current efficiency obtained is around 90 to 95 per cent. In the cases of many cyanide baths this figure may be as low as 50 to 60 per cent, and a chromium bath gives the lowest efficiency of all, around 13 or 14 per cent. Therefore, it is essential that these values be corrected for the loss of metal plating. This can be done rather easily by determining the cathode efficiency. Assume cathode efficiency to be 90 per cent for the zinc bath, 10 per cent of the current passing through did not deposit zinc but plated out, more than likely, hydrogen. Thus, the calculations are off by 10 per cent. By adding 10 per cent more time, that is, 10 per cent of 492 min. or 49 min., instead of 13 hr. and 40 min., 14 hr. and 29 min. are required for the plating operation, the corrected time for 90 per cent cathode efficiency.

Above each table, the element valence, electrochemical equivalent, and density of the metal are given. From these data, the weights of metal occupying 1 sq. ft. of surface, 0.001 in. thick are calculated. The time necessary to deposit this amount at a given current density is determined and is placed in its proper position in the table. The first figure appearing in each square denotes the time in hours, while the second one denotes the time in minutes required to produce a deposit of given thickness at a definite current density. A slide rule was used in all calculations. These figures could have been determined more accurately, but this really is unnecessary as the table is as accurate as the baths used.

The last two rows at the bottom give the weight in grams and ounces ounces of metal per sq. ft. for the different thicknesses.

By referring to Table VIII it can be seen that to deposit zinc at five amp. per sq. ft., a coating of this metal, 0.0005 in. thick will require 1 hr. and 22 min. By referring to the last two rows it will be seen that this thickness of metal has 8.35 gm. or 0.295 oz. of zinc per sq. ft. of plated surface.

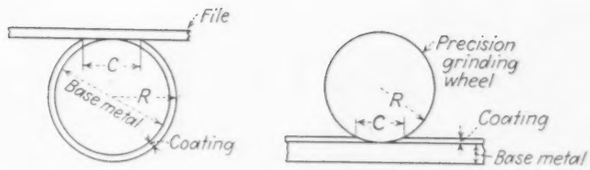

FIG. 2—Diagram of procedure in measuring the deposit thickness of plated metal by the measle chord method. Left, a file is used when a curved surface plate is measured, and right, a precision grinding wheel is used on a flat surface.

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TABLE XVI

IRON Fe++

Electrochemical equivalent = 0.0002893
Density = 7.88.
Weight = 0.00234 x 929.088 x 7.88 = 18.51 gm.
18.51 divided by 0.0002893 = 64,140 sec. = 1069 min. = 17.82 hr.

C. D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	*1-47	3-32	5-20	7- 6	8-53	10-41	12-24	14-13	16	17-49	35-38	53-27
5	21	42	1- 4	1-26	1-47	2- 8	2-29	*2-52	3-12	3-32	7- 4	10-36
10	11	21	32	43	53	1- 4	1-15	1-25	1-36	1-47	3-34	5-20
15	7	14	21	28	35	43	50	57	1- 4	1-11	2-22	3-33
20	5	11	16	21	27	32	37	43	48	53	1-47	2-40
25	4	9	13	17	21	26	30	34	38	43	1-26	2- 8
30	4	7	11	14	18	21	25	28	32	35	1-11	1-47
35	3	6	9	12	15	18	21	24	27	31	1- 1	1-32
40	3	5	8	11	13	16	19	21	24	27	53	1-20
45	2	5	7	10	12	14	17	19	21	24	47	1-11
50	2	4	6	9	11	13	15	17	19	21	43	1- 4
gm. per sq. ft.	1.851	3.72	5.56	7.42	9.28	11.10	12.95	14.80	16.65	18.51	37.02	55.53
oz. per sq. ft.	0.07	0.13	0.20	0.26	0.33	0.40	0.46	0.52	0.59	0.66	1.32	1.98

* read, 1 hr. 47 min.

TABLE XVII

NICKEL, or COBALT
Ni++
Co++

Electrochemical equivalent (Ni++) = 0.0003054 gm. per coulomb.
(Co++) = 0.0003040 gm. per coulomb.
As there is only 3 per cent difference all calculations are based on Ni.
Density = 8.75.
Weight = .00254 x 929.088 x 8.75 = 20.61.
20.61 divided by 0.0003054 = 67,820 sec. = 1132 min. = 18.8 hr.

C. D.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.001	0.002	0.003
1	*1-53	3-47	5-41	7-34	9-20	11-12	13- 4	14-50	16-48	18-52	37-44	56-36
5	22	45	1- 7	1-30	1-52	2-15	2-37	2-59	3-21	3-42	7-24	11- 6
10	11	26	34	45	57	1- 8	1-19	1-30	1-42	1-53	3-46	5-39
15	7	15	23	30	38	45	53	1	1- 8	1-15	2-31	3-46
20	6	11	17	23	28	34	40	45	51	56	1-53	2-50
25	5	9	14	18	23	27	32	36	41	45	1-31	2-16
30	4	7	11	15	19	23	26	30	34	38	1-15	1-53
35	3	6	10	13	16	19	23	26	29	32	1- 5	1-37
40	3	6	8	11	14	17	20	23	25	28	57	1-25
45	3	5	8	10	13	15	18	20	23	25	50	1-15
50	2	5	7	9	11	14	16	18	20	23	45	1- 8
gm. per sq. ft.	2.06	4.12	6.18	8.25	10.31	12.38	14.45	16.50	18.55	20.61	41.22	61.83
oz. per sq. ft.	0.071	0.15	0.218	0.29	0.36	0.44	0.51	0.58	0.66	0.73	1.46	2.18

* read, 1 hr. 53 min.

Nitriding Tank Track Pins

AN unusual mass heat treating operation of nitrided tank tractor pins is carried out at the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich. Loads of 12,000 lb., containing 10,000 track pins are nitrided to a depth of 0.025 to 0.030 in., racked as shown in Fig. 1. The pins are 9½ in. long and ¾ in. in diameter, and are used to tie the tractor shoes together, in much the same manner as a hinge pin. For each tank, 140 pins are needed, 70 to a tread, and the pins are of Nitralloy "G" modified steel, having the following analysis:

ELEMENT	PER CENT
Carbon	0.30 to 0.40
Silicon	0.30, max.
Manganese	0.40 to 0.60
Chromium	1.40 to 1.90
Molybdenum	0.15 to 0.25
Aluminum	0.90 to 1.40

Prior to nitriding, the pins are heat treated by oil quenching from 1650 deg. F., and drawn at 1300 deg. F. This treatment results in the following physical characteristics:

Tensile strength	123,000 to 145,000 lb.
Elongation	15 per cent in 2 in.
Reduction of area	45 per cent
Izod impact strength	45 ft-lb., max.

The pins are loaded on a cylindrical fixture. The bottom layer of pins is set on an alloy grid that rests on the bottom of the fixture, holding 2000 pins solidly packed and held together with steel banding. Successive layers are handled similarly, and when five layers are packed, the load is lifted out of the fixture and lowered into the furnace.

Nitriding is carried on in two Lindberg Cyclone nitriding furnaces, equipped with alloy retorts 38 in. in diameter and 54 in. deep. Self-sealing insulated covers are provided and ammonia is introduced through pipes extending through the cover. The furnaces are gas-fired and are of the forced convection type in which heated air is circulated under pressure and at high velocities, as shown in Fig. 2. Because the retort is heated by forced convection, there is no chance for radiation to affect temperature uniformity.

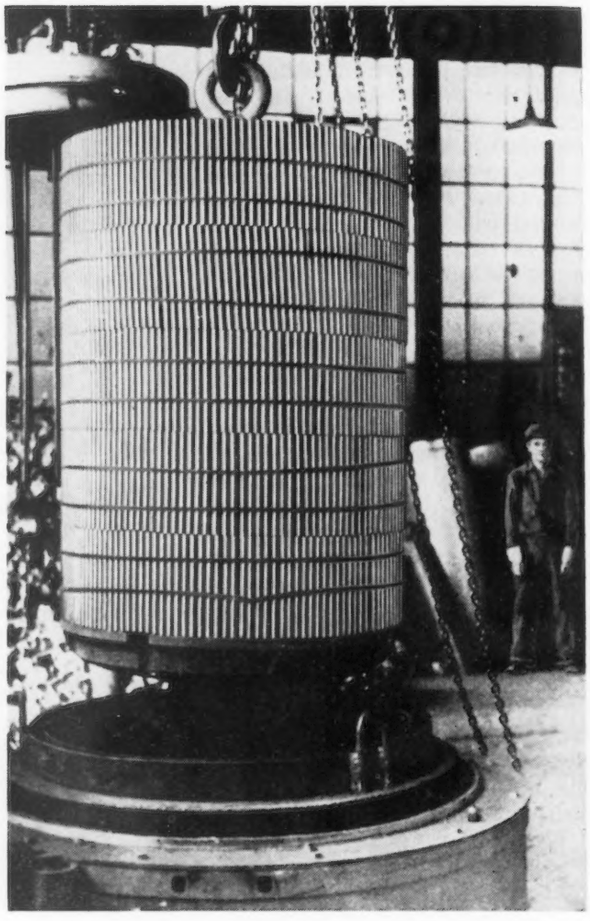

FIG. 1—In tiers of five layers, 10,000 tank tractor tread pins are nitrided in one batch at the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich. This load is just being withdrawn from the nitriding furnace, built by Lindberg Engineering Co., Chicago

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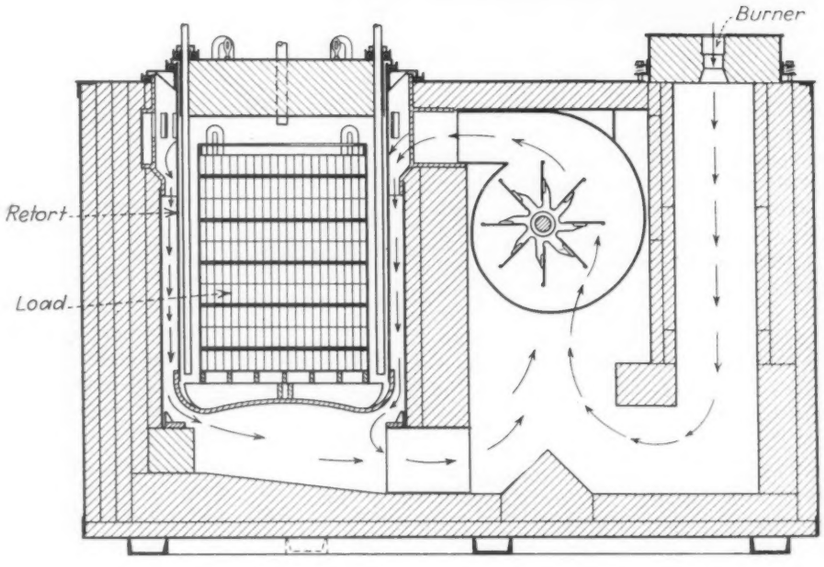

FIG. 2—This Lindberg Cyclone nitriding furnace is gas-fired and is of the forced convection type in which heated air is circulated under pressure and at high velocities.

During the six months since the furnace was installed, more than 300,000 pins have been nitrided without the loss of a single pin. End to end run-out specifications on straightness are 0.010 in., maximum, and it has never been necessary to reject a pin for warpage. Loads handled are staggered between the two furnaces in use so that one heat is completed at the middle of the week and the next heat at the end of the week, giving a weekly production of 20,000 pins.

Control of Tool Shapes

° ° °

By JONATHAN C. HINTON
Manager, Grinder Division, William Sellers & Co., Inc., Philadelphia

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• • • With defense demands rapidly increasing and production going full blast, no one needs to be reminded that time is important. Yet many plant executives still let skilled machinists waste time grinding their own tools—often grinding away hard-to-get tool material—and generally producing incorrect points that dull and break down prematurely. But even if tools are supplied by a central toolroom, the savings in time and tool costs are little unless the tools are ground accurately to predetermined shapes. The fundamental principles of tool shape control were first established by Frederick W. Taylor, whose work, extending back 60 years, the author reviews before offering a modern interpretation.

SHOP management continues to concentrate its best efforts on the selection of types and capacities of machine tools. The fact that at least 90 per cent of the efficiency of the machine tool depends upon the quickly destructible cutting edge of a 1-lb. piece of tool steel is passed over as perfectly obvious. There ends the matter. This is a grave mistake. In many instances the production from machine tools has been doubled by giving proper consideration to this 1-lb. piece of tool steel and in every case where the matter is given justified attention, the production is materially increased. Hence in these days when effort is being made to get the most out of existing equipment as well as the new machinery purchased for defense production, it might be well to review some well established principles of tool control that are frequently overlooked, or else taken for granted. In general, three elements are involved:

(1) Selection of tool shapes for best cutting efficiency, including economic factors.

(2) The problem of grinding the tool to the selected shape without injury to the tool steel, in the fastest time and with the least expense.

(3) The provision of sufficient tools to prevent loss of machine time waiting for sharp tools.

None of these principles is new. In fact the governing characteristics for tool shapes as we have them today were determined well before the turn of the century as a result of approximately 45,000 experiments in cutting metal made by Frederick W. Taylor under the guiding hand of William Sellers and his associates. In the course of these tests, over 800,000 lb. of steel were cut up at a cost of about $135,000.

Taylor's experiments were summed up in a now famous paper on "The Art of Cutting Metals," presented before the American Society of Mechanical Engineers in December, 1906. Some of the principles enunciated were established by experiments extending back 26 years. Since this is an age of rediscovery of fundamental principles as well as establishment of new ones, it might be worth while, as well as interesting, to review the sequence of facts these experiments brought out:

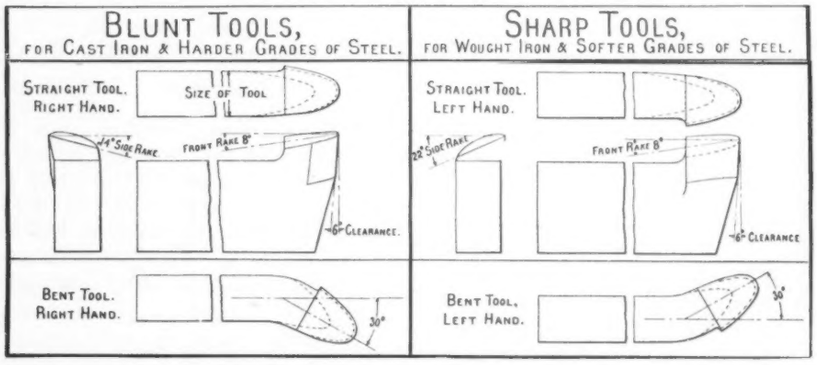
Year 1881. Taylor found that round nosed tools were good for higher cutting speeds than diamond shaped tools then commonly used, and that coarse feeds and slow speeds would remove more metal in a given time than fine feeds and fast speeds.

Year 1883. That coolant in proper volume, correctly controlled, would increase work accomplished by the tool as much as 30 to 40 per cent. In this year also, Taylor set up formulas giving mathematical expression to the laws determined by the tests, showing that the longer the tool is called upon to operate, the slower must be the speed; also correlating by formula the effect of the cut upon the cutting speed. In other tests, he demonstrated that the power to feed a dull tool equals the tangential power to drive the cut.

Year 1886. Discovered that the thickness of the chip of a given material has a greater effect upon the cutting speed than any of the other elements. Demonstrated the practical application of the broad nosed tool for roughing cuts at coarse feed and high speed, and its superiority to round nosed tools operated with coarse feed and slow speed.

The above were the principal discoveries relating to shape of tool, chip proportions and relative speeds and feeds. Between 1894 and 1900, the chief developments were in cutting tool materials. Cutting experiments were begun using

self-hardening tool steels like mushet, the forerunner of present-day high speed steels. These early steels contained from 5 to 8 per cent tungsten. Taylor with his associate White experimented with the substitution of chromium for manganese in the original mushet steels and a lowered carbon content, which had been up around 2 per cent. The method of heat treatment was also modified. These Taylor - White tungsten - chromium steels, when heated to the melting point and cooled, would accomplish from two to four times as much work as tools treated in the manner usual for that time. Later, in 1906, Taylor found that the addition of a small quantity of vanadium to tungsten-chromium steel would improve the hardness and the durability of his tools. These were the first modern high-speed steels. It is interesting to note in these present days of tungsten shortage that Taylor and White also experimented with the substitution of molybdenum for tungsten because of the discovery in the early 1900's of immense deposits of domestic molybdenum ores.



TWO standard Taylor forms of round nose roughing tools for lathes and planers. On a Sellers universal tool grinder, the desired curvature is reproduced on successive tools by means of a cam or former plate. A single former will handle curves of similar shape on a wide range of shank thicknesses.

Twelve Basic Factors

In the years that have passed since Taylor's active work was done, there have been many developments in cutting materials and in the metals they are called upon to cut, but the basic fundamental of the art of cutting metals has not changed in the intervening years. The 12 variables that Taylor encountered in his experiments still have to be taken into account today both in the laboratory and in the production shop. These variable factors are:

(1) Quality of the metal to be cut—its hardness, toughness and other characteristics that resist change of form.
(2) Diameter of work.
(3) Thickness of chips.
(4) Depth of cut.
(5) Elasticity of work and of tool.
(6) Shape or contour of cutting edge and clearance and lip angles.
(7) Chemical composition of tool steel and its heat heatment.
(8) Use or non-use of coolant.
(9) Duration of the cut (life between grinds).
(10) Pressure of chips on tool.
(11) Available speeds and feeds.
(12) Pulling and feeding power of machine at various speeds. Let us analyze these factors from the shop management point of view to see just which ones are within control of the shop.

(1) The quality of the material to be cut is usually determined by the purpose for which the finished article is intended. The shop has little jurisdiction over this factor, the exception being high sulphur screw machine stock, which is selected primarily for its free machining properties.

(2) Diameter of the work, or the length of time a tool runs against cold material. This factor has an effect due to heating. It applies to the length of a planer stroke also, and is beyond the jurisdiction of the shop for the same reason as the first factor.

(3) and (4) Thickness of chips and depth are two factors usually subject to change by the shop, but the time element should also be considered.

(5) Elasticity of the work and tool, including the machine elements. The first factor is not often subject to change by the shop, and the machine used is usually the best available. For a specific job the shop has small chance of changing these factors.

(6) The shape of the tool, although it ranks sixth in importance among the 12 variables, is one of the few really important factors determined and controlled by the shop.

(7) The characteristics of the tool steel are subject to predetermination and when correctly selected are capable of a wide range of application without further change.

(8) and (9) Whether to use a coolant or not and the decision as to the most economical tool life between grinds are all subject to shop control.

(10) Pressure of chips is determined by other related factors.

(11) and (12) are both controlled by the equipment available.

We find then that of the first five factors, which are listed in the order of their importance, three are practically fixed on any particular job and the other two, while subject to change, are more closely related to the choice of cutting speed rather than the shape of the tool. None of the factors from (7) to (12) has any considerable influence on the shape of the tool either. Hence, the shape of the tool becomes the most important single factor within the control of the shop management and is to a great extent independent of other factors. It then becomes a matter of extreme importance that the shape of the tool be correct. It is one of the fundamentals of the art of cutting metals.

When designing standard tools, four ultimate objectives should be kept in mind:

(a) To leave rough work true and sufficiently smooth for economical finishing.
(b) To remove metal in the shortest time.
(c) To produce the largest quantity of work with the least amount of regrinding of tools.
(d) To be able to handle a large variety of work and materials with the same tool shape.

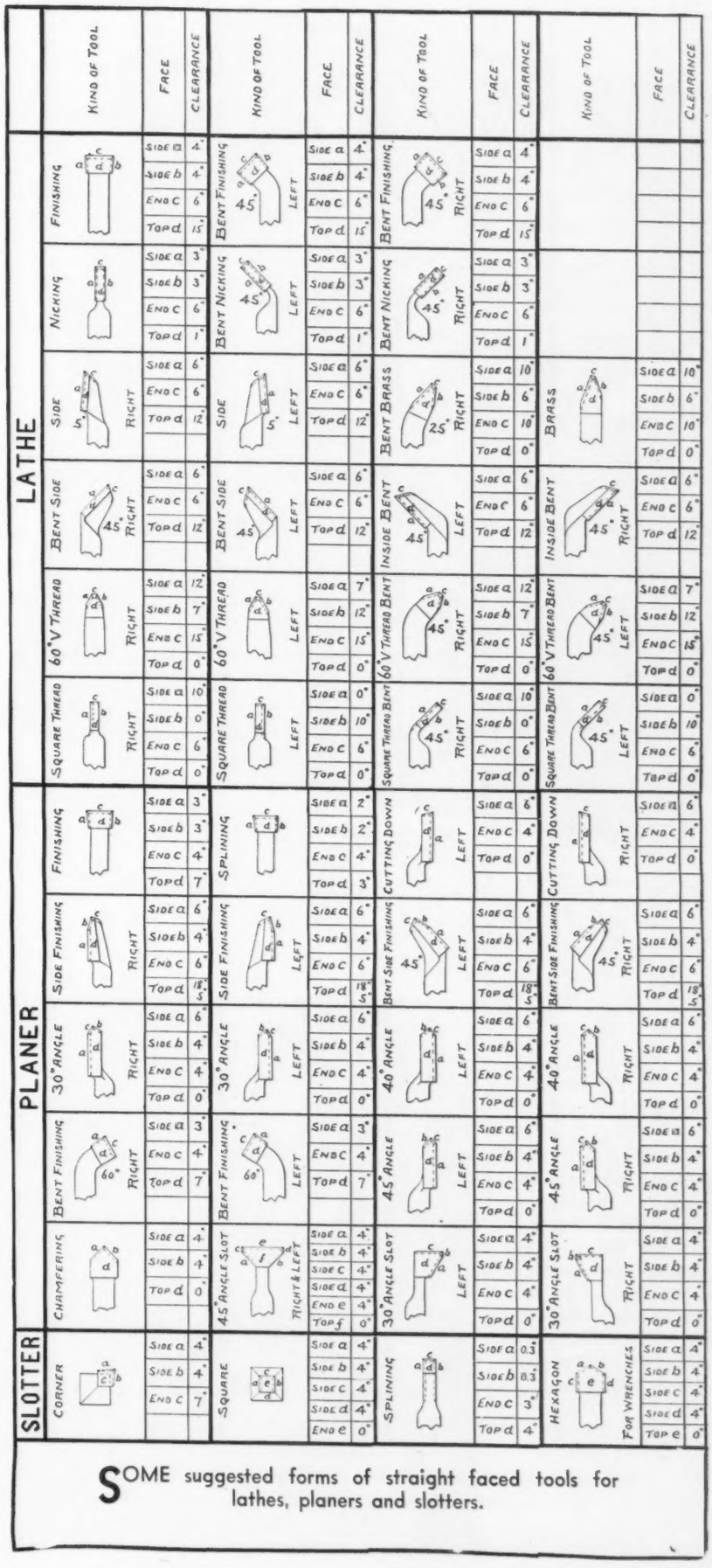
Compromises have to be made in the application of these principles. The Taylor standard shaped roughing tool, for example, is good for only five-eighths the cutting speed possible with a shape for which high cutting speed is the only factor considered. In this case freedom from chatter is the principal cause for sacrificing consideration (b). Too few shapes are far better than too many shapes. They should be carefully selected and assiduously maintained. When tool shapes are few in number, more accurate rate setting is possible and supervision is facilitated. Sticking to a few standard shapes avoids the tendency for individual hand grinding which can never be practiced to any extent without adding to the cost of production.

In the thousands of experiments made by Taylor, he came to the definite conclusion that practically all straight roughing jobs could be most rapidly done with turning tools ground to one of two proved shapes. These two shapes are called blunt roughing tools for cast iron and harder grades of steel, say 0.45 per cent carbon and over, and sharp roughing tools for wrought iron and the softer grades of steel. These standard tool shapes are illustrated. They may be straight right or straight left, or bent right or bent left, making eight shapes for turning all general work.

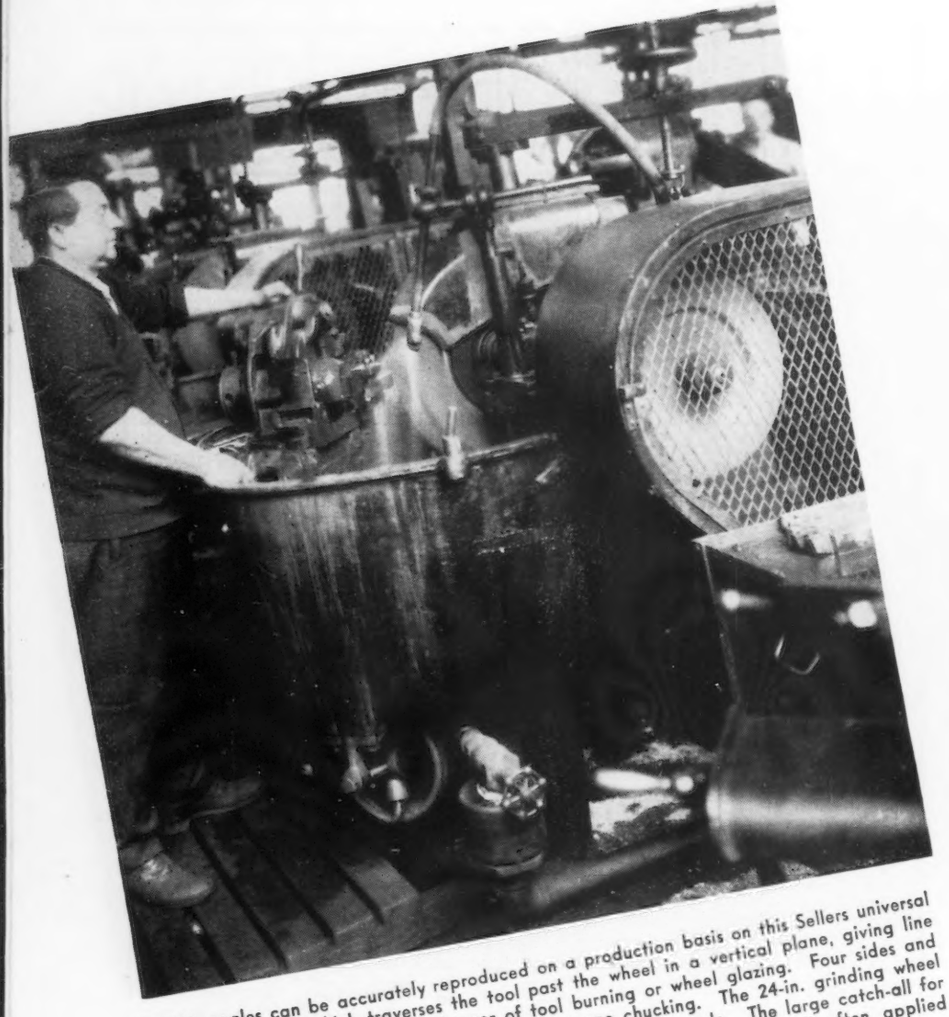
Taylor proved that tools should be ground with the smallest and most acute lip angle obtainable without danger of the tool spalling off. Consider first the clearance angle or relief under the lip which permits the work to run free of the tool after it passes the lip. If the clearance angle here is insufficient to stand clear of the turned surface, spalling may result by pressure on the front of the tool. The clearance angle must also provide for the helix angle generated by the tool on the work as it feeds along the piece. These considerations fix the clearance angle for general purpose tools at 6 deg.

The second angle to consider is back slope, which permits the tool to be fed into the work to the required depth. Here we select the angle that is the sharpest possible, while still safe from spalling off due to pressure and pull of the chip. This angle has been determined as 8 deg. for all general purpose tools.

With proper clearance angle and back slope, the tool can be fed into the work with reasonable pressure because it clears the work when running, but now the chip is shot back against the tool holder. It becomes necessary therefore to direct springy, curly chips to one side. This is done by giving the tool side slope. Here again it is necessary to keep in mind the danger of spalling off the edge of the tool and the necessity of feeding the tool along the work into new metal, while at the same time avoiding the possibility of the tool digging in. These considerations fix the side slope at 14 deg. for the harder metals and at 22 deg. for the softer metals. The combination of these angles gives a lip angle of 68 deg. for hard steel and cast iron, and 61 deg. for softer steels. Measurement of the lip angle is made down the flank of the tool and diag-



SOME suggested forms of straight faced tools for lathes, planers and slotters.



TOOL angles can be accurately reproduced on a production basis on this Sellers universal shaping grinder, which traverses the tool past the wheel in a vertical plane, giving line contact and fast cutting without danger of tool burning or wheel glazing. Four sides and the end of straight face tools can be ground at one chucking. The 24-in. grinding wheel has two conical surfaces forming a V with 90 deg. included angle. The large catch-all for coolant and grinding debris is accountable for the name "tub grinder" often applied to this machine.

onally across the top in the direction that the chips flow when the tool is at work.

The shapes of the cemented carbide tools do not follow the angles we have discussed for high speed steel tools. This is due largely to the main consideration of tool shapes, namely, the tendency of carbide tools to spall off or crumble. For some materials this calls for much greater lip angles than are used on high speed steel tools. The question of cost also enters into the picture inasmuch as it has been demonstrated that tools with sharp lip angles are more expensive to grind both as to material and as to time.

The above discussion covers the bare fundamentals of tool shape. The main thought that should be kept in mind is that no matter what shape of tool is decided upon as being best for a given job, it is highly important that all of the tools used for the job be formed and ground to the accepted shape. More tools are made useless by improper grinding methods than by any other single factor. It is, of course, possible for a workman to grind tools fairly accurately to gages, but it takes a good man to do it and considerable expense for gages and added grinding time. The solution of this important problem lies in centralized tool room control and in machine grinding.

Tool Supervisor Needed

The first step in the system is the appointment of a skilled man to oversee tool supply and service.

o o o

TOOL grinding facilities should be segregated in the tool crib and the work of grinding tools handled by men trained for this work. Only in this way can tool angles, once selected, be consistently maintained.

o o o

He may rate as a tool engineer or tool supervisor, or in a small shop he may be known as foreman, gang leader or even mechanic. But however he may be designated, his responsibility should be to see that each job is provided with proper tools of the correct form and correct grind. At this he must be an expert.

Tool supply means more than one good tool with which to start a job. It means an adequate supply. If the job is one on which a good tool should stand up for one hour, at least six tools should be on this job for each half day of operation. This provides insurance against loss of time due to accidents to tools. When a bomber drops its last bomb, it is through for the day. Just so with a machine tool when cutting tools are gone.

A good system of tool service demands sufficient tool steel. It demands equipment with which to produce and maintain an adequate supply of tools of correct shape. The total cost of the initial supply of tool steel and servicing equipment may well be less than one-half of the cost of one of the machine tools in a shop of 300 men. Based on our experience, we recommend the following equipment for tool servicing:

(1) One Sellers universal tool grinder for each group of 200 to 300 production machines using single point tools.

(2) One drill grinder for each 50 drill spindles using drills from ½ to 3 in. in diameter.

(3) One point thinning machine for thinning the web and cross checking the concentricity of the above drills.

(4) One smaller drill grinder for each 150 drill spindles using drills under ½ in. diameter.

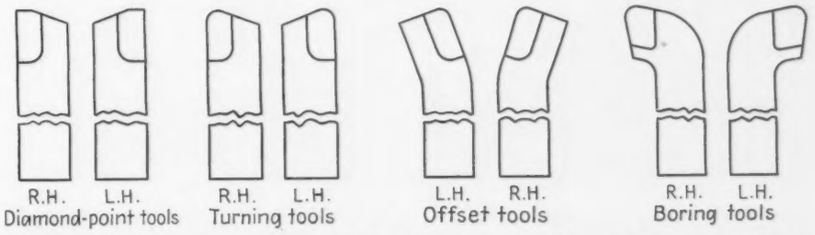
If tungsten carbide tipped tools are extensively used, a double or triple wheel pedestal grinder with tilting tables may be required and possibly a lapping wheel for touching up operations.

Grinding machinery will require about 400 sq. ft. of floor space for each 300 production machine operators. Tool storage will require about 200 sq. ft. with suitable shelving.

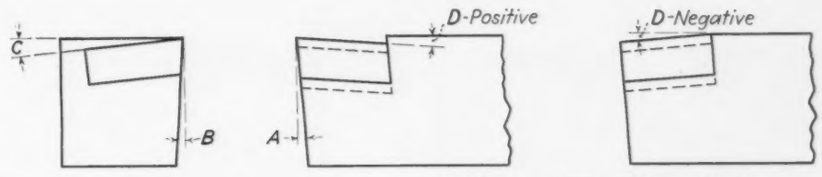
Universal Tool Grinder

Mention should be made here of the Sellers universal tool grinder, since it occupies a unique place in the field. Tools with straight edges and surfaces and all convex tools can be mounted or chucked in these machines so that the various surfaces may be ground quickly to the precise angles desired without removing the tool from the chuck. The overheating of certain portions of the tool while grinding is a prolific source of tool failure and in Sellers grinding machines, this condition is eliminated by providing an abundant stream of water to keep the tool cool and the wheel clean, and also by using the principle of line contact between grinding wheel and tool. The tool is traversed past the wheel quickly, grinding a straight face on the tool with the periphery of the wheel. The tool is fed to or across the wheel to remove tool material and to maintain a true grinding surface on the wheel. Furthermore, a narrow line of contact between the wheel and the work allows a high unit pressure on the grains of the abrasive wheel. This pressure is sufficient to break out grains of abrasive as they become dull so that sharp, free-cutting grains are constantly being presented to the work, thus assuring rapid grinding with a wheel that automatically keeps itself sharp and eliminates wasteful wheel dressing.

Another distinct advantage of this machine lies in the fact that correct rake and clearance angles are produced at the cutting edge. A fully universal chuck permits any face of the tool to be presented to the wheel at any angle, so that when oscillated in a vertical plane tangent to the periphery of the wheel, a straight surface is generated. For grinding convex tools, an auxiliary chuck is provided which permits the tools to be swung through an arc in a vertical plane, irregular shapes being controlled by a cam or former plate. Adjustments of the regular tool holder are such that the desired clearance angles can be maintained around the nose of such tools. This machine grinds any cemented carbide or high speed steel tools, either straight or convex faced. It does all the work necessary to finish to shape from either forged or bar stock cutting tools for lathes, planers, boring mills, etc., and will accurately reproduce all the desired angles and clearances.



SOME suggested forms of carbide tipped tools. Rounded corners of less than 1/4 in. radius can be ground with three flats, one at 45 deg. and the others at 22½ and 67½ deg. respectively. For larger diameters, cam grinding is preferred.



	Cast iron	Hard cast iron	Steel
A - Front clearance angle	4°	2°	4°
B - Side clearance angle	4°	2°	4°
C - Top side slope	6°	6°	15°
D - Top back slope	Tools below 1½ x 1½ 6°		
	Tools above 1½ x 1½ 4° negative		

Suggested clearance angles for carbide tipped tools.

Savings in Tool Inventory

Such grinding equipment has reduced tool steel inventory 75 per cent. It has reduced the quantity of tool steel required by as much as 87 per cent. Before installing a centralized tool room control, for example, one large forging manufacturer gathered up 18,000 lb. of tool steel around the shop and put it in the tool crib. One year later the tool steel inventory was 4500 lb. Before installing this tool servicing equipment, this manufacturer purchased about $8000 worth of tool

steel a year. Afterward, he purchased $4700 worth per year while output of machined forgings increased nearly 50 per cent.

Another manufacturer who uses large quantities of cut-off tools in automatics was spending 3 to 4 min. to regrind each tool when dull. Changing to a line-contact grinder with a special holder, he was able to grind 16 tools at a time in 4½ min.

Another example of increase in efficiency through the installation of a central tool room is in the case record of a local shop. Test runs were made with tools of standard shapes. The results showed that the controlled shape tools removed metal 38 per cent faster than the hand ground tools. Before then workmen on planers, boring machines, lathes, slotters and shapers were grinding their own tools by hand and were losing 16 per cent of their time grinding tools, although the machine time loss was only 12 per cent, since the machines were often left running while the operator was grinding his tools. This lost time was eliminated by central tool room grinding. Furthermore, before the central system was installed tool steel consumption was 0.8 lb. per ton of finished product; afterwards, it dropped to 0.435 lb. per ton.

Tool Supply to Machines

There are many systems of tool supply in operation. One of the most common permits the machine operators to draw personally from the crib, tools with which he may or may not be charged. He is responsible for their safe keeping and proper use until returned. He brings back dulled tools to the crib and receives sharp tools in place of them. This simple system has certain advantages in some shops, especially the small shop or jobbing shops. It permits the mechanic to explain his exact needs to the grinding machine operator. On the other hand, it frequently results in much loss of time and waste of expensive and scarce tool steel.

Another system which has worked sucessfully in many of the larger shops provides one or more tool runners with small, specially constructed tool trucks. They pass through the shop at regular intervals collecting dulled tools and delivering sharp tools directly to the production machine operators.

Hydrogen Determinations in Steel

IN the courses of research on the absorption and expulsion of hydrogen in steel making, reported in *Stahl und Eisen* by S. V. Hofsten, Bo Kalling, F. Johansson and O. Knos, the conditions affecting the hydrogen content of steel during refining in various steelmaking processes were studied and the fluctuation in the hydrogen content of expelled gases carefully followed. These gases were collected by lowering a bell over the steel bath, a pipe from the top of the bell serving to remove the gases for analysis. Improved sampling conditions were later developed by substituting a crucible of graphite for the bell, making sampling easier and permitting representative samples to be taken over a longer period of time.

The results of the investigations indicate that when the hydrogen content of the gases is known, its amount in the steel can be calculated with the aid of Sieverts value for the solubility of hydrogen in steel. The value calculated from the gas samples is believed to be reliable, giving a good picture of the actual hydrogen content fluctuations in the molten steel.

The expulsion of hydrogen from molten steel, kept boiling in a hydrogen-free atmosphere, is closely related to the quantity of carbon eliminated in refining; a relationship that may be expressed in the form of a curve designated as the "normal curve." This curve was established for a series of melts in a coreless induction furnace, high hydrogen values being insured at the beginning of sampling. Increased solubility of hydrogen at elevated temperatures causes a displacement of the "normal curve" with temperature.

If the furnace atmosphere contains hydrogen or hydrogen compounds, some hydrogen can be taken up from the furnace gases at the same time other hydrogen is expelled by the working of the charge. The hydrogen content will then not drop to zero, but approach a certain stationary equilibrium value at which absorption and expulsion take place at equal rates. When the initial hydrogen content is high, the carbon content, reduced to attain this equilibrium, does not apparently have to exceed 0.3 per cent. Hydrogen absorption from the furnace atmosphere is determined mainly by the hydrogen content of that atmosphere and the protective action of the slag. High temperatures seem to promote the absorption of hydrogen, especially with basic melts, but the rate of refining does not appear to affect the absorption.

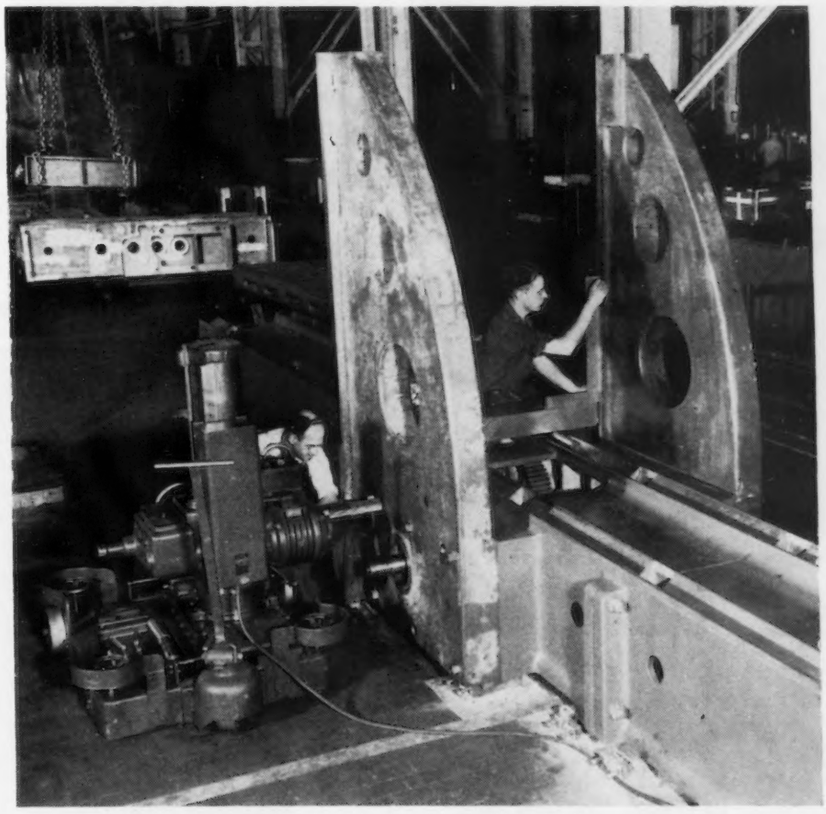
Hydrogen introduced into the charge by rusty or oily scrap is nearly all expelled during the melting of the charge. If the carbon is then reduced to 0.2 to 0.3 per cent, the hydrogen content of the charge can no longer influence the hydrogen content of the steel. Moistened slaked lime, wet ore, leaking cooling pipes, and other such conditions may, however, introduce a considerable amount of hydrogen into the steel during refining, and hydrogen introduced by these means may result in an excess of the gas in the finished steel if decarburization is not carried far enough after melting. There is some evidence that hydrogen absorbed during tapping, for example by contact with wet ladle lining or from too heavily

Planers by Fisher

TO help relieve the shortage of machine tools, the Office of Production Management last winter asked Fisher Body division of General Motors Corp. to undertake the manufacture of 100 Liberty planers in sizes ranging up to 72 in. Later the number was raised to 125. The step was taken to help out the Liberty Planer Co., Hamilton, Ohio, which furnished the engineering and design requirements. Less than two months after the contract was signed early this year, the first planer was delivered by Fisher Body, which had set up a production quota of 10 months for completion of the entire task, or an average production of 12½ planers a month. Actual production is about one planer every two days.

The patterns for these planers were made in the Fisher pattern shop in Detroit, and the beds and other components are being machined and assembled in the big die shop of the Grand Rapids Stamping division. Both these well equipped plants undertook to do this job with the equipment on hand, without buying new or special machinery. In fact, Fisher Body was selected for this contract because it had the necessary machine tools capable of handling large bed castings, tables and housings, and the machinery in the die shop was mostly of a general purpose nature readily suited to machine tool building. Large surface plates were also available for "laying out" big beds. A few special tools, like the radial horizontal drill illustrated, previously developed by Fisher Body engineers for use in automotive die work have also proved highly useful in building planers where it is frequently feasible to bring the machine to the work rather than the work to the machine.

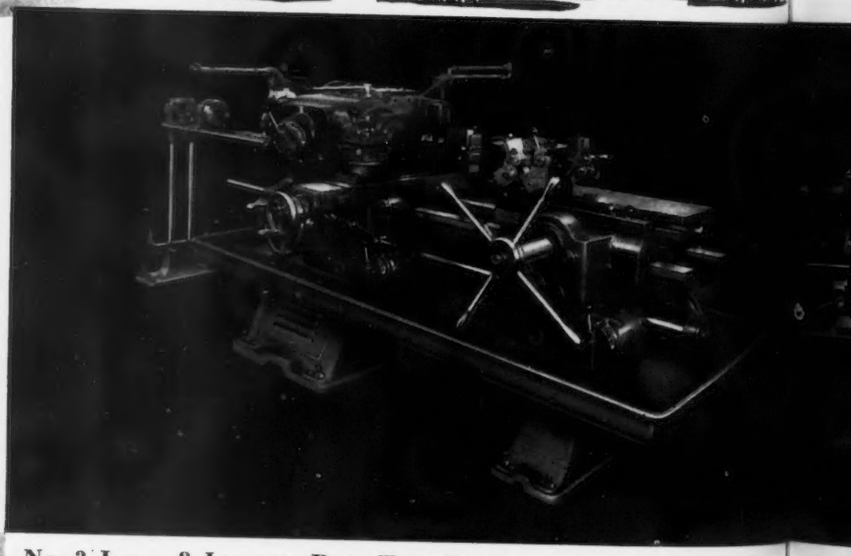
NORMALLY involved in the preparation of patterns for body dies for General Motors cars, this Fisher Body shop in Detroit is shown turning out patterns for Liberty planers. In the foreground is the pattern for the center section of one of the largest planers, with a bed 43 ft. long and 6 ft. wide. Fisher engineers are credited with simplification of design to speed up production.



A PORTABLE radial drill, developed by Fisher Body engineers, is being used here to ream dowel pin holes in the housings of the planers. This special horizontal drill was originally designed for use in production of automobile body dies. The drill eliminates much unnecessary handling of heavy work since the drill itself can be moved about to each job. Accurate positioning is obtained by leveling screws mounted at each corner. Drill spindle and drive mechanism may be revolved a full 360 deg. about the upright column.

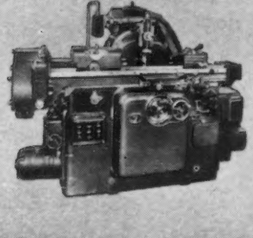
YOU WOULDN'T TRADE THIS F

LIKE many an early leader in the machine tool field, David H. Hilliard received his training in the Vermont shop, of which Jones & Lamson Machine Company is a direct successor. When war broke out in 1861, Hilliard worked night and day to complete a wagon load of heavy telescopic rifles. These he drove to Concord and presented to the Governor of New Hampshire to arm a picked company of Sharpshooters.



No. 3 Jones & Lamson Ram Type Universal Turret Lathe with standard bar equipment.

AUTOMATIC THREAD GRINDERS



OPTICAL COMPARATORS

RAM TYPE UNIVERSAL TURRET LATHE

FOR A WAGON LOAD OF RIFLES

In 1861 a wagonload of rifles was a major contribution to national defense. In 1941 it might help some, but it wouldn't help enough.

Yet on the vast scale in which the fate of the world is being weighed today, one of the heaviest contributions to the survival of freedom is an intangible contribution, and it comes from the same original sources as Hilliard's wagonload of small arms.

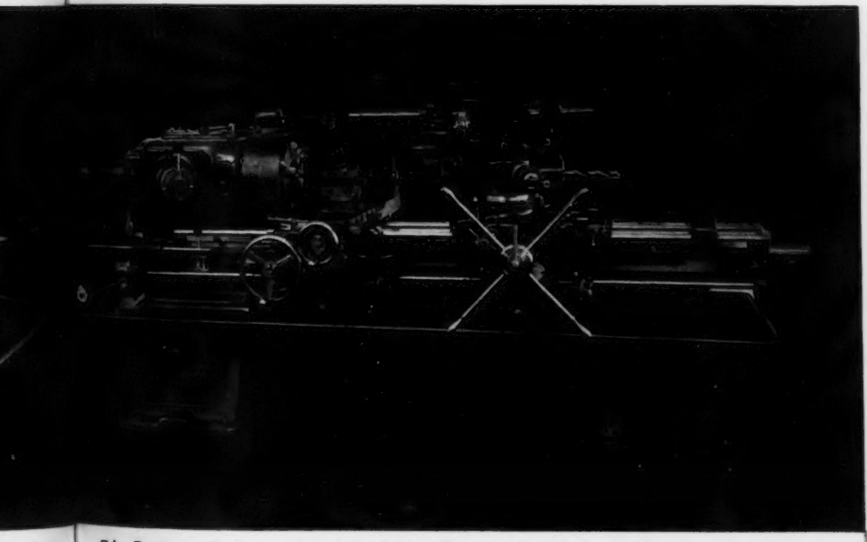
This contribution consists of the skill, experience and adaptability of a machine tool engineering and precision manufacturing organization whose continuous development began with Hilliard's predecessors over a century ago. Continued in turn by men like Hubbard, Kendall, Robbins, Lawrence, Howe and Hartness, this unbroken progress makes Jones & Lamson machine tool technique available to you in its present high speed, modern form.

With Jones & Lamson equipment you can speed defense production now, and with it later you will be in position to earn a living profit in the hard years ahead.

That's why it pays to put production problems up to Jones & Lamson engineers. That's why it is so advantageous to be Jones & Lamson equipped. Illustrated catalogs of this equipment are available, and inquiries from large plants or small receive careful study here.

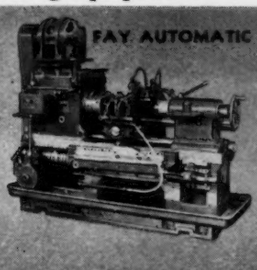
JONES & LAMSON

MACHINE COMPANY, Springfield, Vermont, U. S. A.



7A Jones & Lamson Saddle Type Universal Turret Lathe with standard chucking equipment.

Manufacturers of Ram & Saddle Type Universal Turret Lathes . . . Fay Automatic Lathes . . . Automatic Thread Grinding Machines . . . Comparators . . . Automatic Opening Threading Dies and Chasers

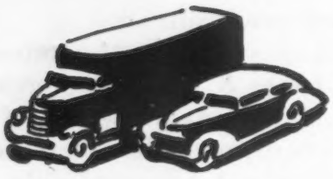


J&L

PROFIT PRODUCING
MACHINE TOOLS

Assembly Line . . .

• Advent of war brings drastic but timely moves affecting automobile industry . . . From now on, only two factors will control automobile production—materials and labor, with greatest emphasis on materials in the immediate future.



DETROIT—The start of the war has brought to the automobile industry and most of its suppliers a more severe curtailment of civilian production and a greater unemployment than had been anticipated for this season of the year. By the time these words appear in print, the production of tires and of passenger cars and many parts and accessories will be at a complete standstill. Shutdowns will last until at least the first of the year, and then the resumption of production will be on greatly curtailed schedules.

Wartime restrictions struck sharply first at rubber and then at automobiles. The rubber shutdown was announced tentatively within four days of the start of the war and, shortly thereafter, curtailment so severe as to represent virtually an order to cease production came through for the automobile industry.

The moves are drastic. At the same time they appear to be timely and, in a sense, very fortunate for all concerned. This represents an attempt to take a little time out—long enough to give the military services, the civilian branches of government, the industry itself, and the public at large a chance to establish new bases of facts from which production schedules can be worked out.

Probably in the long run this business of stopping, taking a deep breath and then deciding just where we are going, will insure more civilian production than we would have had with the continued haphazard chopping away at schedules and quotas.

The situation as it has existed in civilian production in recent months has been unpopular in an extreme degree. It probably has been just as unsatisfactory in the eyes of OPM as it has been in the eyes of the industry. The two were in a position—whether they wanted to be or not—of taking opposing tacks, although certainly both wanted to reach the same goal. But the approach was such that OPM—or OPA—was steadily whittling away at production quotas for civilian goods. The result of such a whittling process could not have been satisfactory for long.

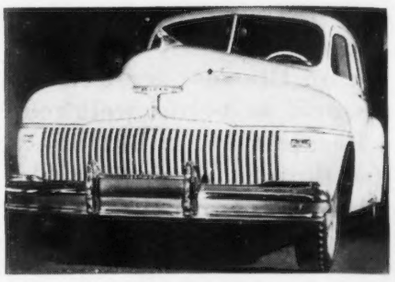
NOW that is at an end. The war makes all men re-evaluate all things. Both the automobile industry and the government will now re-evaluate civilian automotive production. From now on both of them will be in the position of aiming at the manufacture of as many civilian units as can be made, consistent with the amount of material and the amount of labor that is available for civilian work.

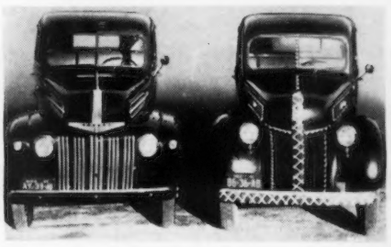
In a sense, this promises to be an uphill sort of an affair. But now, at least, some kind of a goal is apparent, whereas the downhill slide of the last six or eight months has been one in which each faction at times seemed to be suspicions of the other.

From now on, only two factors will control automotive production—materials and labor. Sales should truely become a factor that will take care of itself because the cars in dealers' hands now will represent no backlog at all in the face of increasing demand and decreasing output.

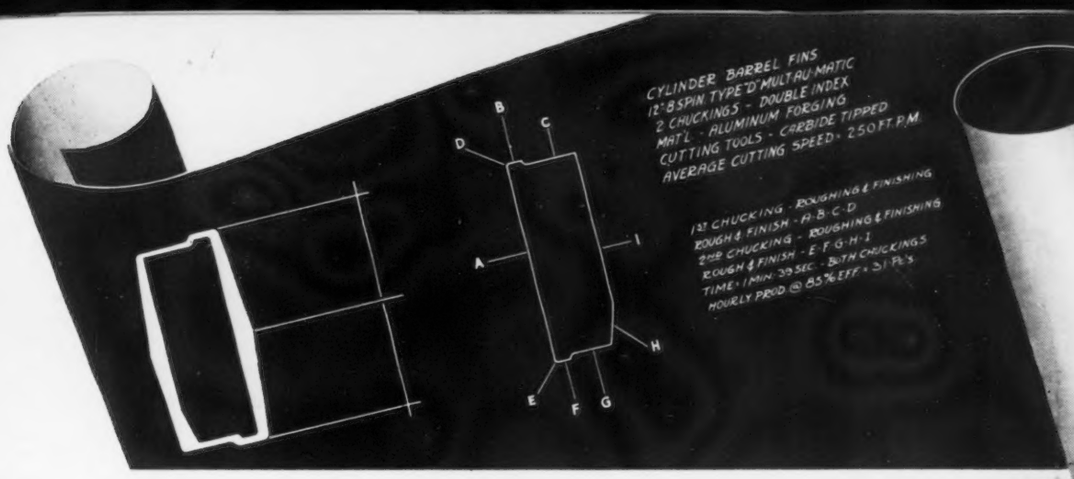
For the immediate future the materials factor is the one which seems to require the greatest amount of study. No one in the industry has been satisfied with the statements that have been made about steel shortages, for instance. Several sets of figures have been floating around contradicting one another, and not even the semi-official figures quoted by OPM authorities at the priorities clinic here Nov. 27 seemed to be very consistent. However, at that time it was indicated that a system of allocations was on its way and that these allocations would benefit the automobile industry, among others. It was stated emphatically that no general system of allocations could be expected in the immediate future, but the Iron and Steel Branch of OPM indicated that about Jan. 1 the first basic steps in allocation of steel products would be taken. This cheered the auto industry a little.

THE labor situation is going to be a very serious one—much more serious now than it was considered a fortnight ago. The depth of the unemployment situation, or





BLACK-OUT CARS: The Oldsmobile, Desoto, Chrysler, and Ford, 1942 models, can be quickly converted into "black-out cars" by the use of luminous paint as illustrated above. The use of brightwork has been eliminated to a great extent, as required by OPM.

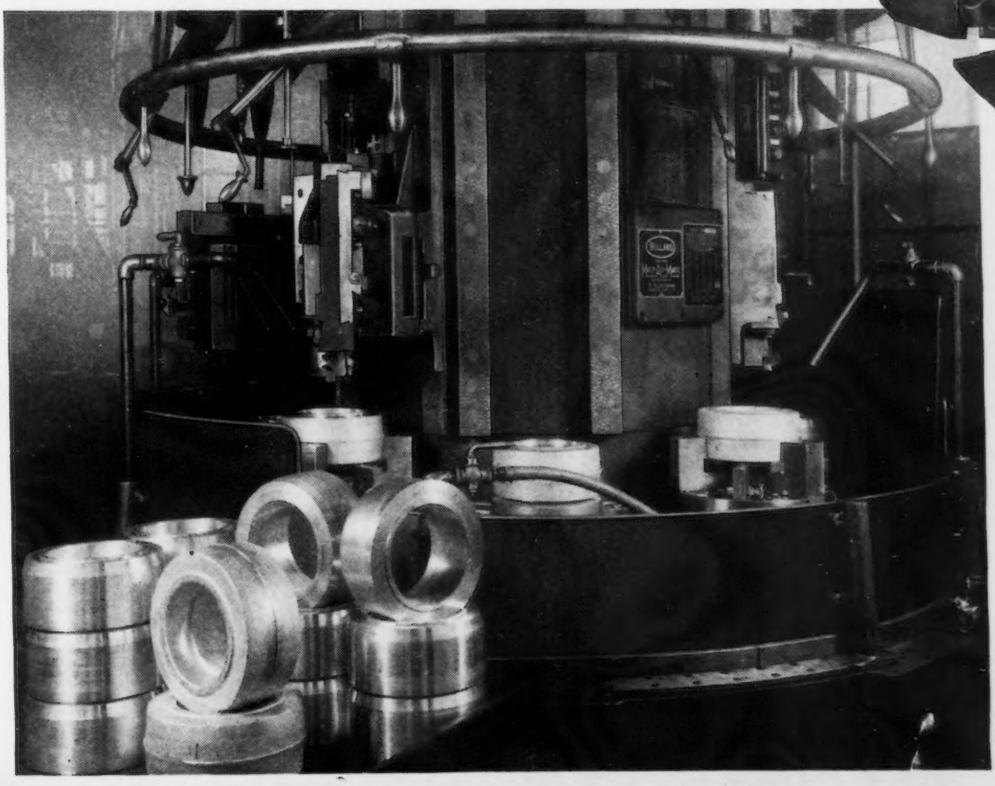


Finish Machined . . .

32 PER HOUR

These forged aluminum airplane engine cylinder barrel fins are machined all over by a Type "D" Bullard Mult-Au-Matic, employing the double indexing feature, which rough and finish machines the 9 surfaces at the rate of 32 parts per hour.

This is a typical Bullard contribution to National Defense work. Any manufacturer with parts of this general character to produce, can use the Mult-Au-Matic method to increase his production. Time studies will be made on request.



THE BULLARD COMPANY BRIDGEPORT, CONNECTICUT

the period when most men would be out of jobs in Detroit, had been estimated as ocurring in March or April. Now it is more likely to occur in January and February.

Many of the men laid off this week will not be called back after the holiday because there won't be work for them to do. They won't get jobs until war work increases enough to create a demand for their efforts. No matter how much extra pressure is put on for the victory program, any great acceleration in employment in the immediate future seems improbable. Even the full-out, seven-day, 24-hour program can't become a reality until materials reach plants here to enable them to step up their output and hire more men. As for the projects that are in the tooling stage now, maybe they can be speeded a little, but schedules already are so tight that the time element simply can't be squeezed much closer.

The brief shutdown over the holiday period and the gradual resumption of operations after the first of the year will give everyone a chance to start out from scratch and work toward a solution of these problems. In accordance with restricted schedules, automobile output in January will amount to only approximately 25 per cent of the output in January, 1941. It is hoped here that before January ends there will be enough accurate knowledge of the materials situation to enable the government to expand the automotive quota somewhat and set a higher figure for February and the spring months.

OFFICIALLY the bright work ban will not become effective until Dec. 31, according to an order issued by Donald M. Nelson, director of priorities, on Dec. 10, the fourth day after the war started. Under the circumstances (virtually no production in the last half of December anyhow) the extension order means little. We hazard the guess that if OPA is willing to see stocks of bright work used up to avoid waste, it will permit further extension of the deadline, possibly through January.

Most of the "black-out" models have been completed and viewed privately but public announcements are not likely until current stocks of brightly trimmed cars are sold by dealers. A few photographs of the "black-out" models are available and are reproduced herewith. Pictures of the Oldsmobile and the DeSoto are indicative of two opposing methods of handling the problem created by the elimination of bright work. Olds styling involves the use of two-tone color harmony and DeSoto's technique makes use of colors matching the car body. Contrasting stripes are used wherever necessary to brighten up these painted parts and provide necessary accent. In the photographs it will be noticed that chromium is used only on bumpers, bumper guards and some small parts such as door locks which need protection from rusting.

Chrysler's Dave Wallace, president of the Chrysler Sales Division, goes on record as saying that Chrysyer has felt "that the use of chrome and stainless steel metal was being overdone in the ornamentation of cars. For that reason there was less of these metals on our 1942 models as originally designed than on most other new cars. The competitive situation has reached a point where it seemed likely to develop into a race to see who could put on the most bright metal. We welcome the opportunity to prove that an effective job can be done without chrome or stainless steel, except on the bumpers and bumper guards."

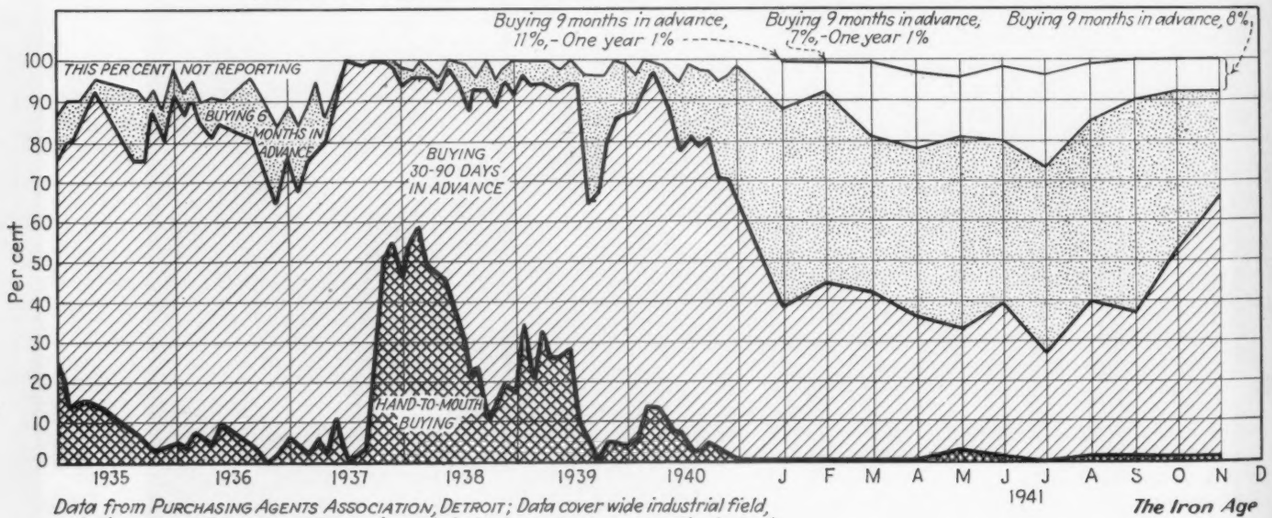
HUB caps are shown in the side views of some of these cars. It will be noted that some of the hub caps are painted contrasting colors or tones, while others are painted very light colors. There is a school of thought which thinks that the reflective quality of hub caps and other trim parts is a valuable safety aid at night.

Ford Motor Co. points out that it anticipated the bright work ban months before the government issued it. On its trucks, something like 90 per cent of the usual bright trim has been removed and only the bumper and rustless steel parking lamp frames remain.

Both the automotive industry and steel makers ought to be interested in a compilation of data on aircraft, materials and alloy specifications prepared by Carnegie-Illinois Steel Corp. for distribution

(CONCLUDED ON PAGE 113)

BUYING TRENDS IN METAL-WORKING FIRMS IN DETROIT



Data from PURCHASING AGENTS ASSOCIATION, DETROIT; Data cover wide industrial field, including stove, refrigerator office equipment, steel, auto parts, accessory, auto plants, etc.

The Iron Age

McKee can bring your present plant to peak efficiency by

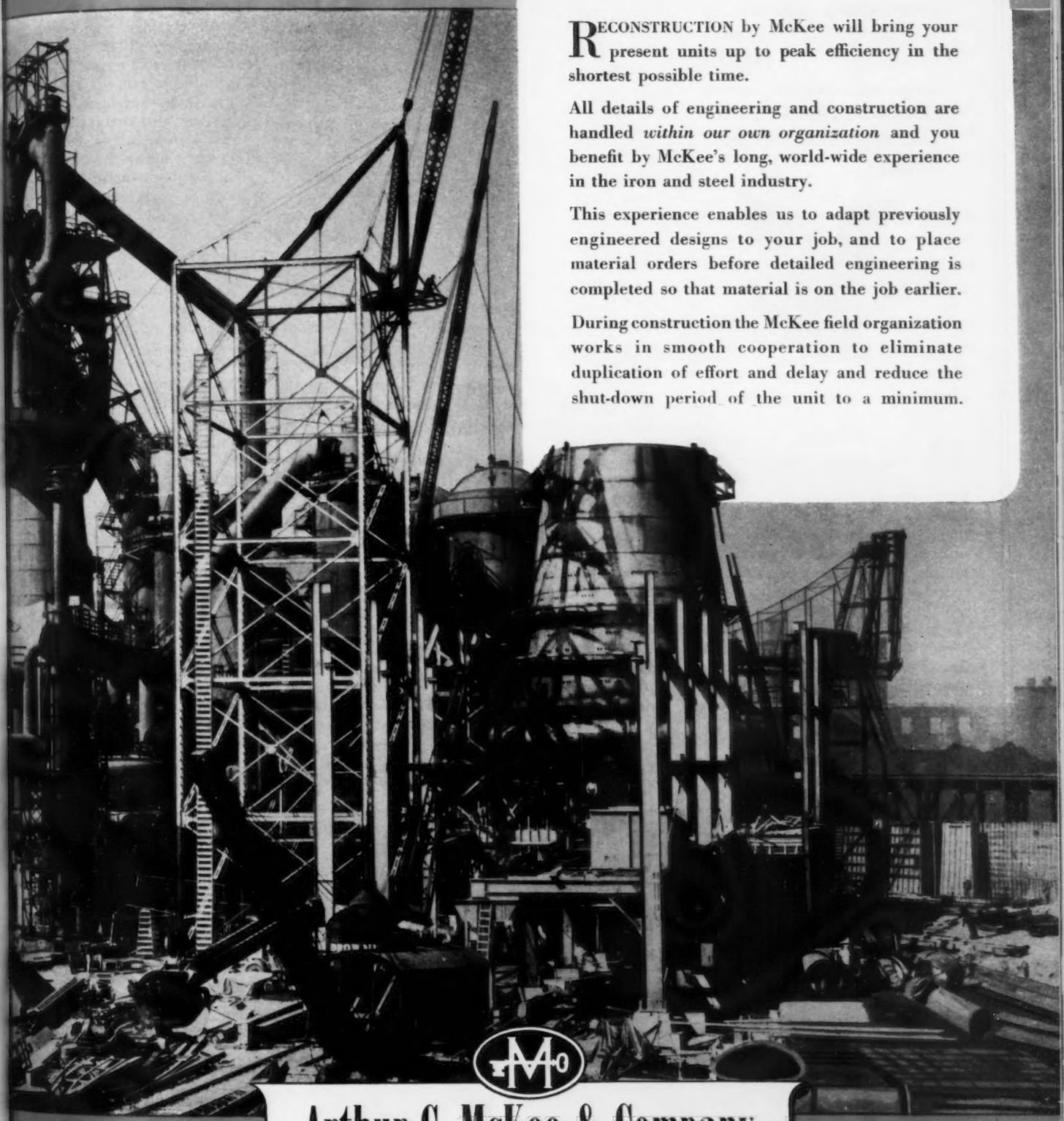
RECONSTRUCTING EXISTING UNITS

RECONSTRUCTION by McKee will bring your present units up to peak efficiency in the shortest possible time.

All details of engineering and construction are handled *within our own organization* and you benefit by McKee's long, world-wide experience in the iron and steel industry.

This experience enables us to adapt previously engineered designs to your job, and to place material orders before detailed engineering is completed so that material is on the job earlier.

During construction the McKee field organization works in smooth cooperation to eliminate duplication of effort and delay and reduce the shut-down period of the unit to a minimum.



Erection of furnace and stoves

Arthur G. McKee & Company

★ *Engineers and Contractors* ★

2300 CHESTER AVENUE · CLEVELAND, OHIO

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NEW YORK, N. Y.

COMMERCE BUILDING
HOUSTON, TEXAS

Washington . . .

• OPM's first step, following entry of U. S. into war, is regulation regarding seizure of war materials wherever necessary . . . Nelson asks industry to report stocks on hand . . . Inventories must be kept down.

WASHINGTON—The pattern of production has been greatly changed by the war that was forced upon the United States. The response to attacks upon this country is a fixed determination to achieve victory, no matter what the cost or sacrifice.

Industry is rushing as far as possible to a complete war footing, and is shifting to a seven-day week, a move considered by the steel industry even before it was announced by the President as a part of the Government full production program.

Civilian users are bound to suffer further from a lack of steel and other metals as the result of the Administration policy to slash civilian use of all metals by 50 per cent in order to divert them to war production. As the President said, people will have to do without a great many metal things. The housewife will have to go without new gadgets, refrigerators, cooking ranges, radios and whatnot. New automobiles will become scarce since their production, already slashed by 44 per cent, face a further substantial curtailment.

SHARP cuts are to be made in juke boxes, and weighing, amusement and gambling machines. To save steel railroad cars are to be standardized. Public utilities will have to get OPM permission before undertaking extensive expansion of property or equipment. Means for conserving metals that come from the Far East have been intensified greatly in view of the Japanese naval action.

Small civilian industry is pinched harder by the all-out victory program but plans are being rushed to gear it and its employment to war output so far as possible.

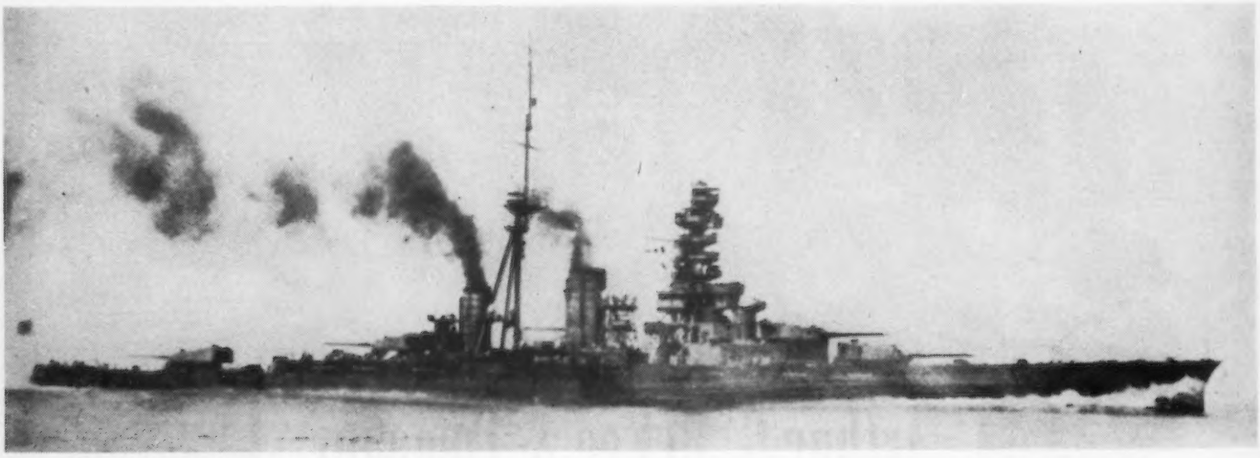
Definite decision has been made to so speed up defense production that actual deliveries during 1942 will greatly exceed those of 1941 to provide in increasing volume both the United States, England and other powers fighting the Axis forces with weapons of war. There have been no official figures on what this production will be but it is estimated that war steel will attain an enormous magnitude, perhaps 60,000,000 ingot tons or even more.

THIS would be a 71 per cent rise over the estimate of 35,000,000 tons for defense and essential civilian supply in 1942. It is certain that the war steel output is going to be greatly increased. Because of the serious shortages of scrap and pig iron the conclusion is obvious that civilian users will have to go hungry since the raw materials, the greatest factors of limiting production, will go in large part to war output. It is hoped that expansion of blast furnace and converter capacity will by the end of next year have developed to a point where the shortages will be considerably relieved.

Another reminder of the realities of war, fitting in with the speeding up of defense production, was the initial emergency priority regulation issued by the OPM Priorities Division providing for the prompt acquisition of war materials whenever normal sources of supply are inadequate. There is to be a much closer scrutiny of inventories and any surpluses in private hands will be grabbed and OPM says as much. Normal supplies will be requisitioned if such action is considered necessary to defense.

Director of Priorities Donald M. Nelson in an appeal to manufacturers to report stocks on hand, said that many are holding inventories, particularly of metals, in excess of present demand. Those holding

ONE DOWN, MORE TO GO: The sinking of this 29,000-ton Japanese battleship "Haruna" by Army bombers on the northern coast of Luzon in the Philippines was announced Dec. 11 by Secretary of War, Henry L. Stimson.



FEATURES LIKE THIS REDUCE SET-UP TIME

...Extend Variety of Jobs...Increase Output

TO all of us except the single set-up, continuous production people, output has far greater significance when considered in terms of the total time (including set-up) required to complete the job. That's why any machine feature which reduces set-up time . . . aids production . . . increases the variety of jobs which may be handled . . . brings smaller quantities within the profit line.

In the CINCINNATI Nos. 2-18 and 2-24 Plain Automatic Milling Machines, there are several features of quick set-up: The arbor supports and arbor may readily be removed and replaced without dismantling other parts. This is an important consideration when setting cutter gangs like the one illustrated —left. One nut clamps and unclamps the quill, which is provided with a micrometer dial for accurate cross adjustment. Covers over the spindle speed and table feed change gear stations are hinged to facilitate changing gears.

Those enumerated above and other features of quick set-up with automatic-table-cycle production are described in catalog M-965. Write for your copy today.

CINCI NATI

THE CINCINNATI MILLING MACHINE CO. CINCINNATI, OHIO, U.S.A.

TOOL ROOM AND MANUFACTURING MILLING MACHINES . . . SURFACE BROACHING MACHINES . . . DIE SINKING MACHINES

supplies of iron and steel scrap also were asked to report.

THE Inventory and Requisitioning Section that was established will administer the power to requisition materials and supplies as provided in the Executive Order of the President issued Nov. 19 pursuant to an act of Oct. 10, 1940, and an act of Oct. 16, 1941.

Through the new section, OPM may requisition materials directly or may review and approve requisition orders issued by other Government agencies, the outstanding ones being the War and Navy Departments. Heading the section is E. A. Tupper. The section is under the general supervision of L. J. Martin, Chief of the Compliance and Field Service Branch.

OPM said that the requisitioning procedure will not be used to interfere with control over the flow of materials to war and essential civilian industries by the priorities system, but will supplement the priority system whenever priority orders are insufficient to get essential materials to the right place at the right time. That is to say OPM is serving notice that if there is any delay in getting the material it will be taken over by the Government.

UNDER war conditions that action can be expected and justified. It is significantly pointed out in the regulations that inventories must be kept down to the "minimum practical working level." Giving further force to this regulation was OPM's warning that it will be strictly enforced and that hoarded scarce materials will be requisitioned as needed. The regulation provides for determination of fair compensation for all property requisitioned.

Notice was given that the survey of OPM's Industrial Branches of existing inventories of scarce materials will be speeded up and that inventory control will be tightened all along the lines.

Nelson Appeals to Holders Of Surplus Metal Piles

Washington

• • • **Placing particular** emphasis on supplies of metals, including iron and steel scrap, Director of Priorities Donald M. Nelson last week warned that any surpluses in the hands of civilians will be requisitioned and diverted to military production. Appeal was made to manufacturers holding inventories of materials greater than their immediate needs to make their surplus available and along with holders of scrap supplies they were asked to wire the Director of Priorities giving the size of inventories of critical materials and amounts of each they can spare for allocation to war production. This request was interpreted as a further move toward broadening of the allocation system.

The Nelson appeal followed the announcement of creation of the new Inventories and Requisition Section which, acting under a rigid emergency act, has issued regulations of procedure which provide for the requisitioning of materials.

"We know," Mr. Nelson said, "that many manufacturers both large and small are holding inventories, particularly of metals, in excess of present demand.

"These metals are needed, and needed now, for war. We want to forge every weapon at our command, and we want to do it immediately. Patriotic and voluntary release of inventories will help us, at the moment, more than any other one thing, to do just that.

"Iron and steel scrap is as important as any raw material. I appeal to everyone who has scrap on hand in quantities to respond to this appeal."

He urged a complete nationwide response to his appeal "in order that we may get these materials immediately without having to resort to the slower processes of requisition."

THE BULL OF THE WOODS — BY J. R. WILLIAMS

Ore Shipments on Lakes Shatter All Records

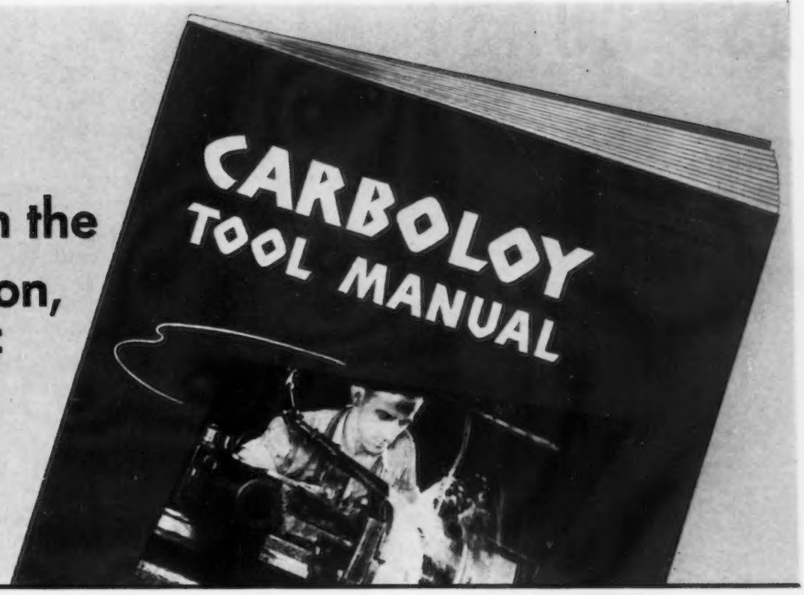
Washington

• • • **Breaking the** previous record by nearly 15,000,000 gross tons, Great Lakes shipments of iron ore during the 1941 season aggregated 80,111,745 tons, it was announced last week by OEM Transportation Commissioner Ralph Budd as the last ore boat of the season left Duluth. He also said that the previous record for all commodities, 142,000,000 tons was exceeded by 25,000,000 tons, rising to 167,000,000 tons.

FREE!

To ALL interested in the Design, Application, Maintenance of Carboloy Tools

This NEW 32-page Instruction Booklet.



To assist users and prospective users of Carboloy cemented carbide tools and blanks, we have prepared this 32-page general instruction manual for general distribution.

This booklet contains, under one cover, complete information on the design, application and maintenance of Carboloy tools. Shows how to design Carboloy tools properly, gives correct shank and tip proportions, effective chip breakers, detailed instructions on brazing of Carboloy tips to shanks, rapid grinding procedure, machine requirements, coolants, tool handling systems, etc., etc.

With the vast increase in use of cemented carbides, an increase of such proportions that the *monthly* output of Carboloy Company today exceeds the total production during the entire year of 1938, it is essential that cemented carbide tools now in use be employed in the most effective manner possible. To this end, we believe this booklet will be of unusual value.

To obtain a copy of this new Carboloy tool instruction manual, simply send coupon at right. In the interests of the National Defense Training Program, requests from technical students, apprentices, instructors, etc., will be gladly filled.

CARBOLOY COMPANY, INC., 11153 E. 8 MILE DR., DETROIT, MICH.

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CONTENTS

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Carboloy Company, Inc.
11153 E. 8 Mile Dr., Detroit, Mich.

Please send a free copy of Carboloy Tool Manual GT-133.

Name_____ Title_____

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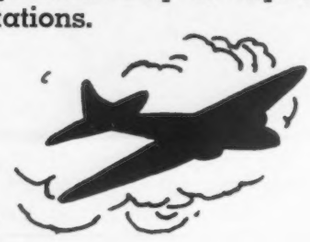
_____ State_____

WEST COAST . . .

• War with Japan brings sharp changes in outlook for supplies of strategic materials . . . Hopes for domestic manganese production, utilizing low grade Far Western ores reported to have suffered a setback . . . California deposits not up to expectations.



SAN FRANCISCO—War in the Pacific will no doubt stimulate Pacific Coast steel demand both for Coast and off-shore bases, but of greater significance to the industry as a whole is its effect upon development of domestic strategic mineral ores.

With the exception of magnesium, tungsten, mercury and vanadium, the prospect is not favorable for local producers taking over much of the burden which imports have carried, and the boats will have to keep running as best they can under war conditions.

Almost simultaneously with the outbreak of war, the outlook for domestic manganese, utilizing low grade Far Western ores, is reported definitely darker. The bubble of hope that this section might be able to furnish a substantial quantity of manganese, which has expanded greatly as the Bureau of Mines investigated ore deposits and carried on investigations at its pilot plant at Boulder City, Nev., now seems likely to burst. Deposits, even of low grade ore, in California have not come up to expectation. Still greater disillusionment is coming from the realization that these ores cannot be economically beneficiated mechnically. The only key which will unlock the close association of manganese with silicon in these ores satisfactorily is said to be chemical . . . and out of the question from an expense standpoint. Heretofore, mining firms with Mexican holdings report that the American government has informed them that it is not interested in Mexican ores, but this attitude now no doubt will change. Holdings near Guayamas on the Gulf of Lower California, will probably be among the first to go into production. Nevertheless, most of the 600,000 tons, about half our requirement for next year, that had been counted on from Africa, the Philippines and British India will still have to come by sea. If it is necessary to count the Philippines out as a source, that will be no great loss, for Philippine ores have not been highly regarded.

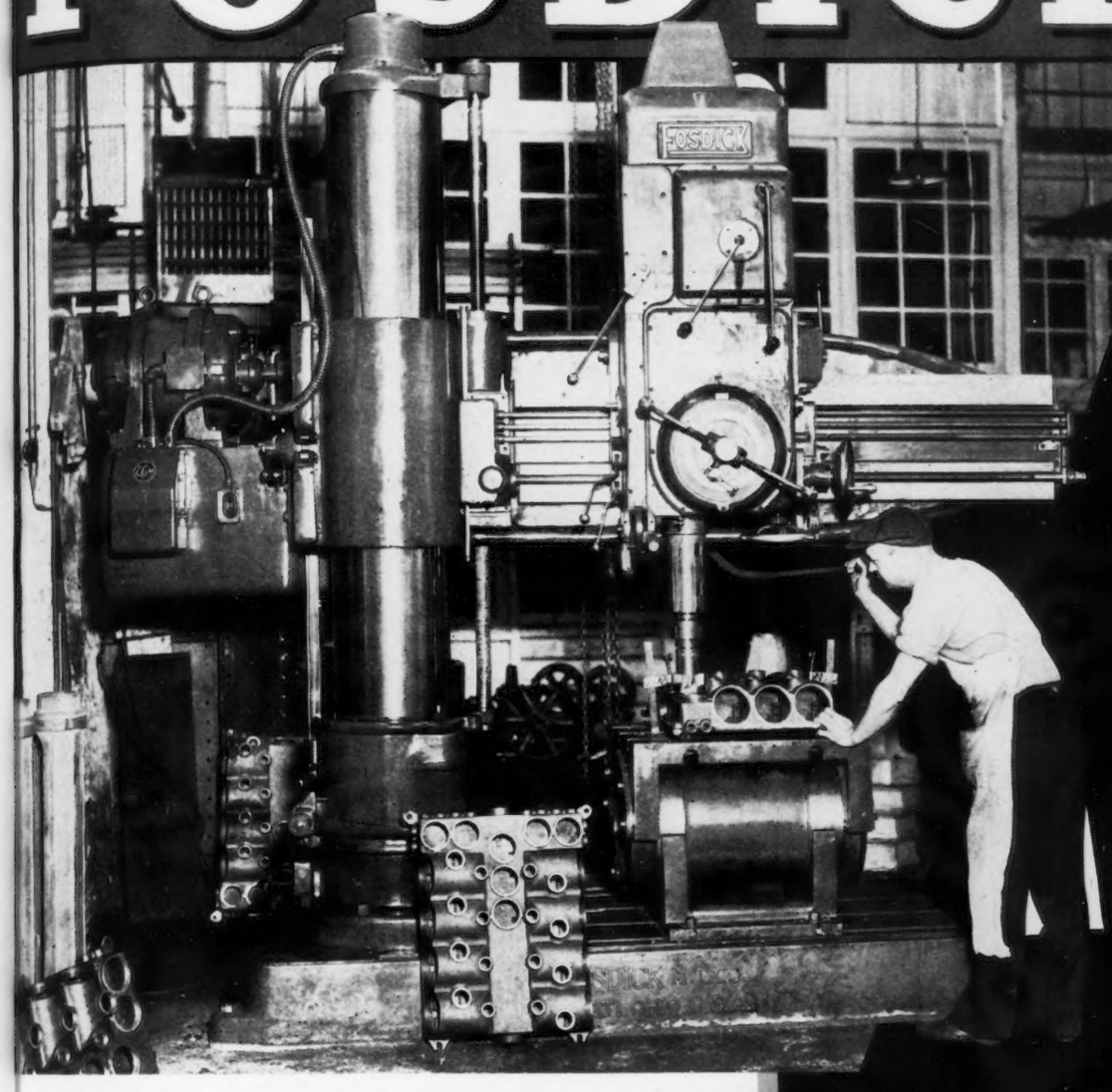
IF we can keep Philippine iron ore out of the hands of the Japanese, who have been its principal consumers, it will be more than adequate solace for whatever we may lose from this source in the way of manganese.

Far more serious is the probable loss, or restriction of chromite from the Philippines, on which we had counted for about one-third of our 1942 requirements. Some expansion of the 125,000 ton figure which had been counted on from the Pacific Coast next year may be possible. Rustless Iron & Steel Corp., which for some time has been utilizing ores from El Dorado County, California, in the foothills of the Sierra Nevada Mountains, is now actively developing another deposit on the western side of California's great central valley northeast of San Francisco Bay. A new independent development is also getting under way in that general region, and smaller projects in the far northern part of the state need only the slight fanning of an increased price to get into production.

The domestic tungsten picture is getting brighter every minute. Estimates of domestic production of 8000 tons of tungsten from

TRAIN LOAD OF TROUBLE: To facilitate and expedite delivery of tanks, a new type of ramp developed by the British permits the tanks to be loaded and unloaded under their own power.

FOSDICK



Boring—Facing—Reaming and Threading operations completed at one setting on Fosdick Radial

On the top of the Panels illustrated you have eight 1 inch diameter holes reamed and threaded . . . eight 1¾ inch holes bored—faced and threaded . . . seven 3⅛ inch holes bored—faced and threaded—making a total of 23 holes completed in 1 hour and 30 minutes.

On sixteen of these holes three operations are performed at an average of a minute and 15 seconds per operation.

The ease and convenience of centralized control and the simplicity of changing tools for various operations and for different diameter holes accounts in a large measure for maintaining a high production rate on this type of work.

When and where a Radial is the machine for the job a Fosdick is the Radial for that job. Write for Bulletin AR.

ECONOMAX *Hydraulic* RADIALS

HYDRAULIC VARIABLE RAPID TRAVERSE TO HEAD

HYDRAULIC COLUMN CLAMP

FOSDICK MACHINE TOOL COMPANY

CINCINNATI · · · OHIO

scheelite obtained in California and Nevada may be substantially increased to take the place of a substantial part of the 5000 tons we expected to get from Chinese wolframite. Lead-silver mines, which disregarded tungsten content in normal times because of Chinese competition, in some instances are now having bright new profit avenues opened up for them. War has not materially altered our prospect of obtaining a minor portion of our requirements from African sources, but here, again, the prod of a higher price, plus favorable tax revision, would no doubt increase already expanding domestic production.

Somewhat disturbing are reports that consumption is rising while production falls in domestic quicksilver. This may be due to working out of known higher grade deposits. Lower grade reserves are by no means fully exploited, however.

IT is no secret now that far more magnesium will be available from Nevada and Washington than was thought possible two years ago, and wide publicity has been given to large reduction plants in production and in prospect.

Further difficulty in obtaining nickel ore from New Caledonia, on the far side of Australia, will no doubt be experienced. Some chromite has also been coming from this source.

To hazard a guess, some sort of subsidy may be necessary to stimulate domestic manganese and chrome production. A far cheaper means of stimulating production of other strategic minerals would be their exemption from the excess profits tax, a shackle placed on this branch of the mining industry this fall. This tax has already, in several cases which have come to IRON AGE'S attention, retarded development. Not a revenue producer, this tax is an effective fetter.

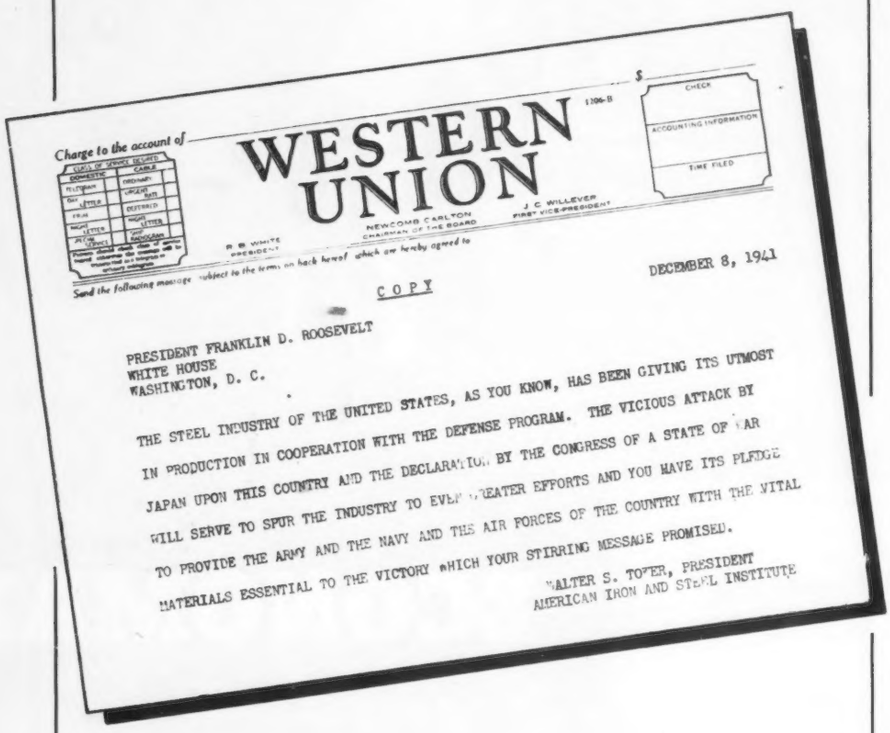
AMERICA'S first retaliation for the Japanese attack, announcement that the program for production of four motored bombers had been stepped up from 500 a month to 1000 a month stimulated civilian morale at a critical moment. From a strictly practical standpoint, such talk must be tabbed for 1943 delivery at the earliest.

No production figures have been announced, of course, but even our Pacific foe knows that the 500 a month goal is still many months from attainment. The core of the four-motor program on the 500 a month basis is, of course, the tri-company contract by which Vega and Douglas will produce Flying Fortresses as well as Boeing.

This tri-company agreement was announced late in May, 1941, and production preparations have been going full speed since then. Even though the conditions attendant to tooling up for this program no doubt have been extremely favorable compared to those which will exist from now on, we shall be extremely fortunate if any of these Fortresses come off the assembly lines in time to attend Japanese almond blossom festivals.

UNITY:

Shortly after President Roosevelt delivered his war address telling of the surprise attack of Japanese bombers on Pearl Harbor, Hawaii, Walter S. Tower, president of the American Iron and Steel Institute, sent this telegram to the President. It pledges the steel industry to produce what the army, navy and air forces need to win.



Charge to the account of

WESTERN UNION

NEWCOMB CARLTON, CHAIRMAN OF THE BOARD — J. C. WILLEVER, FIRST VICE-PRESIDENT — R. B. WHITE, PRESIDENT

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Send the following message, subject to the terms on back hereof which are hereby agreed to

DECEMBER 8, 1941

COPY

PRESIDENT FRANKLIN D. ROOSEVELT
WHITE HOUSE
WASHINGTON, D. C.

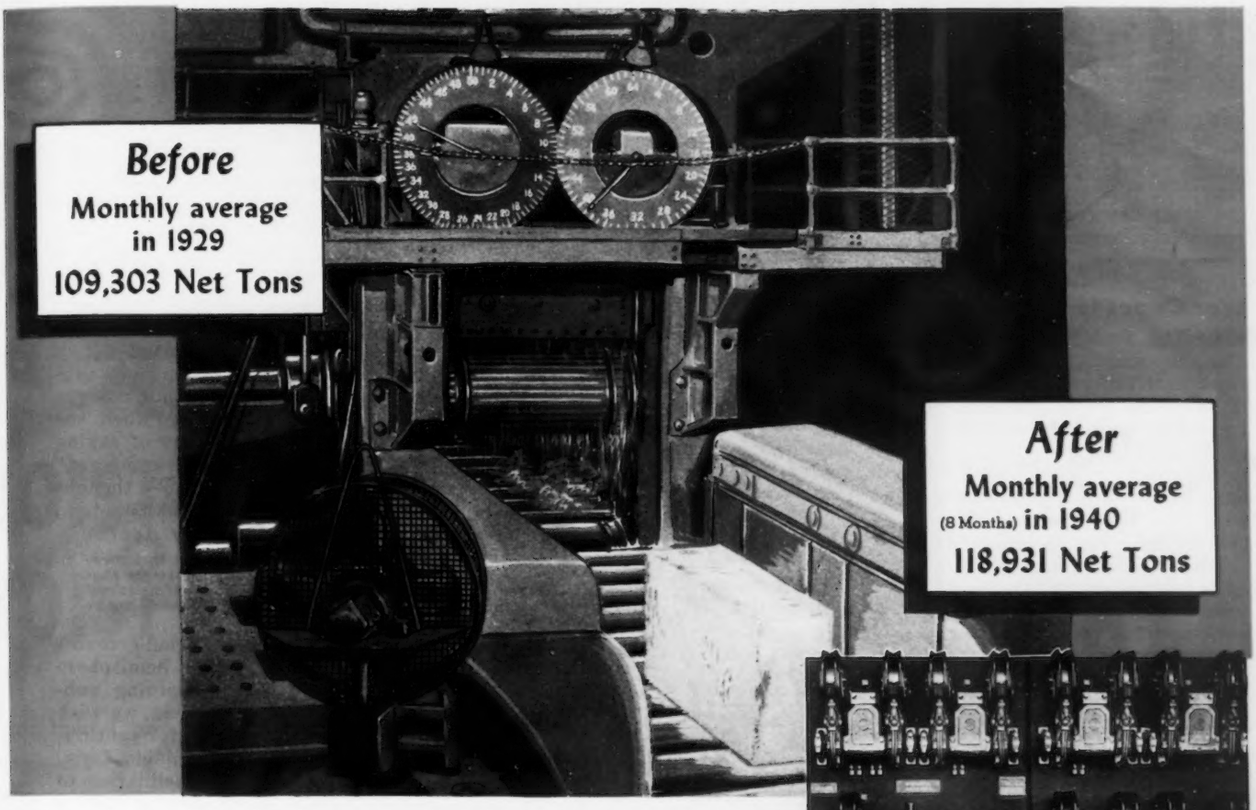
THE STEEL INDUSTRY OF THE UNITED STATES, AS YOU KNOW, HAS BEEN GIVING ITS UTMOST IN PRODUCTION IN COOPERATION WITH THE DEFENSE PROGRAM. THE VICIOUS ATTACK BY JAPAN UPON THIS COUNTRY AND THE DECLARATION BY THE CONGRESS OF A STATE OF WAR WILL SERVE TO SPUR THE INDUSTRY TO EVEN GREATER EFFORTS AND YOU HAVE ITS PLEDGE TO PROVIDE THE ARMY AND THE NAVY AND THE AIR FORCES OF THE COUNTRY WITH THE VITAL MATERIALS ESSENTIAL TO THE VICTORY WHICH YOUR STIRRING MESSAGE PROMISED.

WALTER S. TOWER, PRESIDENT
AMERICAN IRON AND STEEL INSTITUTE

PRESIDENT ROOSEVELT had said: "The output of the steel mills serves as the backbone of the weapons, the airplanes, and the ships on which the fate of free government in this world rests. No greater burden has ever been thrown on a single industry."

OPM DIRECTOR KNUDSEN said: "The hour has come. We must center our efforts on production of the munitions of war. War is here. We are attacked. The Office of Production Management appeals for the utmost effort from American labor and management that victory may come swiftly and be complete. Man hours worked by willing hands will do it."

WILLIAM GREEN, AFL President, said: "There will be no more defense strikes of members of our union."



MODERNIZATION

ups Production over 9600 Tons per month

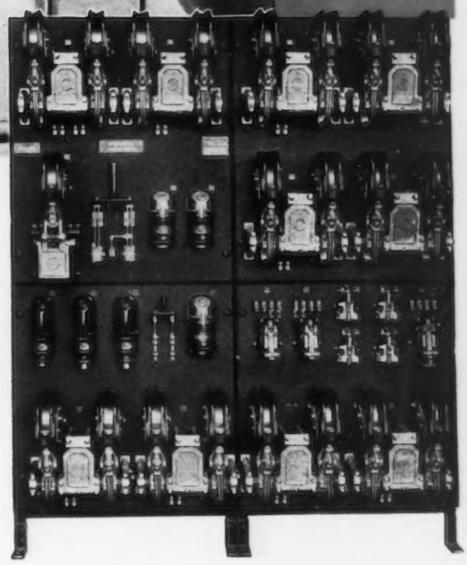
IN THE plant of a prominent steel company, the 44″ blooming mill set a record of 109,303 tons monthly average in 1929. Modernization a short time ago increased production to approximately 118,931 tons monthly average . . . or a gain of 9628 tons per month.

Modernization consisted of new open hearths, increased soaking pit capacity, new heating practice as well as mechanical and electrical improvements on the 44″ mill. New EC&M Controllers were applied on all auxiliary drives—tables, sideguards, screwdown, manipulators, etc.—of this mill.

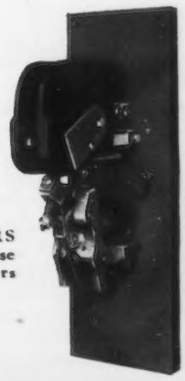
Contributing to the increased production are the EC&M LINE-ARC Contactors used on the new mill controllers. The arms of these contactors are 50% *lighter in weight* and *operate almost twice as fast as previous contactors.* With rolled steel for the magnetic circuit and light-weight alloys for the moving parts, these LINE-ARC Controllers are *lightning fast* in response to the operator's manipulation of the master switch.

Combined with Time-Current (load-controlled) Acceleration Relays, EC&M LINE-ARC Contactor Controllers are the logical choice for industry's direct current motor drives. Ask for Bulletin 925 describing them. The Electric Controller & Mfg. Co., 2700 East 79th St., Cleveland, Ohio.

THE ELECTRIC CONTROLLER & MFG. CO. EC&M CLEVELAND, OHIO



Typical EC&M Mill Auxiliary Magnetic Controller



NEW CONTACTORS
almost twice as fast as those on previous controllers

FOR FAST OPERATION—Specify EC&M LINE-ARC CONTACTOR CONTROL

Fatigue Cracks BY A. H. DIX

Mars Moves In

• • • The engrossment of the automotive moguls with things military is revealed by the opening sentence of a letter Bill Sherman, your Detroit informant, received the other day from the occupant of the No. 1 chair in one of the largest companies:

"Again I wish to tank you for . . ."

War Comes to 42nd Street

• • • The first bombing alarm caught us flatfooted. The war was barely two hours old when the warning came over the radio; we had not yet had time to condition ourselves to the new state, so the alarm was treated as hokum, which later it proved to be. But down in Wall Street, where reflexes are quicker, the response was prompt. Girls fainted and brokers were only a shade less white than they were that day in '29 when someone stuck a futile finger in the dike by bidding 205 for Steel Common.

The following morning the downtown area was treated to another dud alarm. Policemen ordered all pedestrians off the streets causing thousands to be late for work among them Thomas Wendell Lippert, your favorite family journal's managing editor, who was obliged to interrupt his walk from ferry to subway with a half hour's forced stay in a Liberty Street loft building lobby.

Our own interest in bombing incursions is slightly more than academic, owing to the fact that we can almost spit on the bombing priority list's A-1-A objective, the Grand Central Station. It is directly across the street, within 120 feet of us as we type this. A couple of months ago we heard that one of the country's larger industrial firms, whose headquarters face on the same station, changed the doors of all its offices from glass to steel. The move seemed to us at the time to indicate unnecessary apprehensiveness, but not now, as we gaze on the 20 ft. Mercury atop the Station's main entrance and wonder how much of a dent he would make if he nose dives on the bronze skull of Commodore Vanderbilt 70 ft. below.

Uninhibited Cincinnatian

A recent article here told manufacturers whose products are plated with certain scarce metals how to utilize a suitable substitute. The article promised further data later on. A Cincinnati manufacturer asked us if we could get the additional information for him at once. We got in touch with the author; he lent us his manuscript; we had it copied, sent it to the manufacturer, and received this reply:

"I can tell you how much this is appreciated and how valuable it is to our industry."

We are always getting letters beginning, *"I can't tell you how thankful, how useful, how grateful, etc,"* and it is novel to have someone declare flatly that he *can* tell.

Ordnance Dept.

• • • To straighten you out on the matter of shot we telephoned the Ordnance Dept. and learn that there are several kinds of shot. One kind is the solid business end of an armor-piercing projectile. We also learned that shrapnel is not, as we had believed, a name given to jagged pieces of metal with which some shells are loaded. Shrapnel means simply a shell filled with bullets to be scattered by its explosion. Incidentally, the shell got its name from a British general named, you'll never guess, Shrapnel.

How to Frighten Your Friends

You can thank Chet Ober of the advertising staff for the handsomest gift your vocabulary has received in a long time. An erudite adv. agcy. acct. exec. gave it to Chet in payment for a lunch. It is—easy now—*onomatomania*, pronounced onn-owe-matt'-oh-mayn-ee-ah. You are afflicted with it if you constantly have words on the tip of your tongue and can't get them off.

Koroseal Flesh

• • • Tight writing consists of eliminating unnecessary words and making one word do the work of several. If overdone some weird effects are achieved, as instance this one in *Newsweek* detected by Daniel M. Davis of the Sykes Advertising Agency, Pittsburgh:

. . . . bayoneted soldiers patrolled docks, bridges, highways, and bases.

He Keeps Himself in Check

• • • A good voice, we read somewhere, is one that never calls attention to itself and so does not get in the way of the message it is conveying. The same with writing. Dorothy Parker paid Somerset Maugham the highest tribute a writer can give another when she told him, "You have no style," another way of saying *"The highest form of art is the concealment of art."*

The same with magazine page make-up. We thought of our own art and make-up editor, Frank Winters, when we read this recently in *Advertising Age:*

In magazine page layouts there is some danger that modern art technique may be carried to such an extreme that the reader may be impressed by the layout but distracted from reading the pages. . . . Magazines are made to be read . . . their pages should be inviting.

On behalf of your favorite family journal's countless thousands of readers in the western hemisphere and elsewhere, including the single remaining subscriber in Norway and the one in Jugo Slavia, we wish Frank Winters an extra Merry Christmas for continuing to present his material in clean, readable form, and for curbing an art editor's natural inclination to go on an occasional skyrocket, star-spangled layout binge.

Upside Down Bomber Lands on Greeting Card

• • • The silhouette of a bomber with which Frank frequently decorates the "West Coast" section (see page 84), is being used by R. N. Ferguson of International Foils Ltd., Quebec, on a Christmas card with this verse:

**This bomber bears bombs
Not loaded with dread
But wishes for Christmas
And New Year's instead.**

Baby Food and Blutwurst

• • • Which reminds us to mention the names of two Canadian war vessels that figured in a recent engagement with a submarine. They are the *Chambly* and the *Moosejaw*—a new high in cognominal incompatibility. *Chambly* suggests a weak-flavored, watery gelatine, and *Moosejaw* brings to mind a battering ram made of high manganese steel. But to prove that Wm. S., the bard, was right in his remark about names, they won their bout.

Joe Called the Turn

• • • The football experts' score for the season in picking the winners of games expected to be close averaged 58 per cent correctness, which is just slightly better than coin flipping. Thus the pigskin seers can now take their place in the back row along with the business forecasters and prenatal sex determinators.

Looking back, we find that one of the few successful piercers of the future's veil is a Canadian. In the Sept. 9, 1937 issue we reported:

Joseph Schmit, Whigham, Ont., farmer, hoards steel. He has $2,000 worth of new material stored in his barn and expects to cash in at a good profit in the event of a European war.

Puzzles

Last week's walkers arrived at 7 P. M.

Five minutes should be enough for this, but probably won't be:

If an army 40 miles long advances 40 miles while a dispatch rider travels from the rear to the front, delivers a message and returns at once to the rear, how far does he travel?

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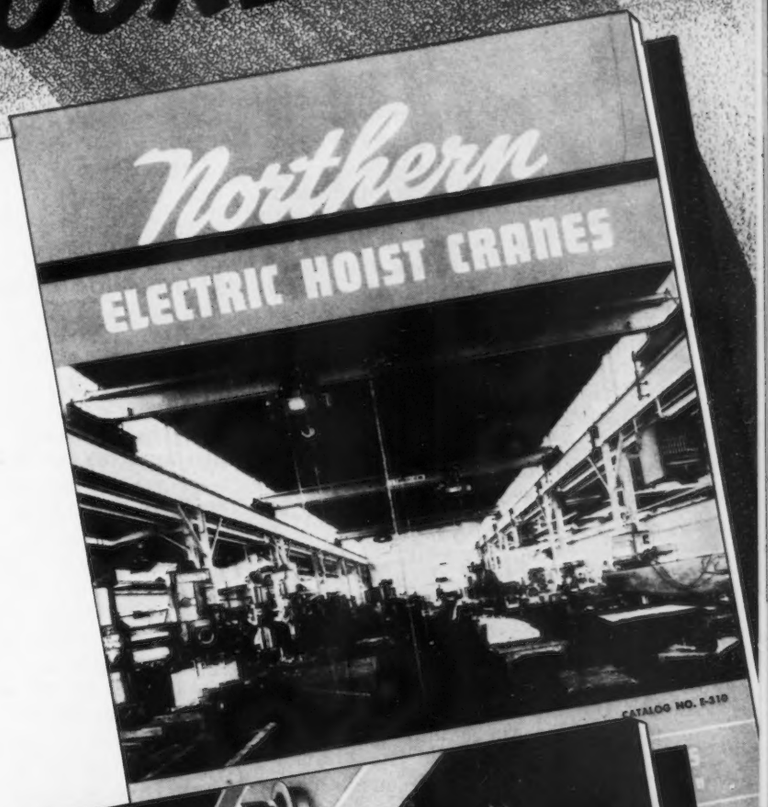
ON ELECTRIC HOIST AND HOIST CRANES



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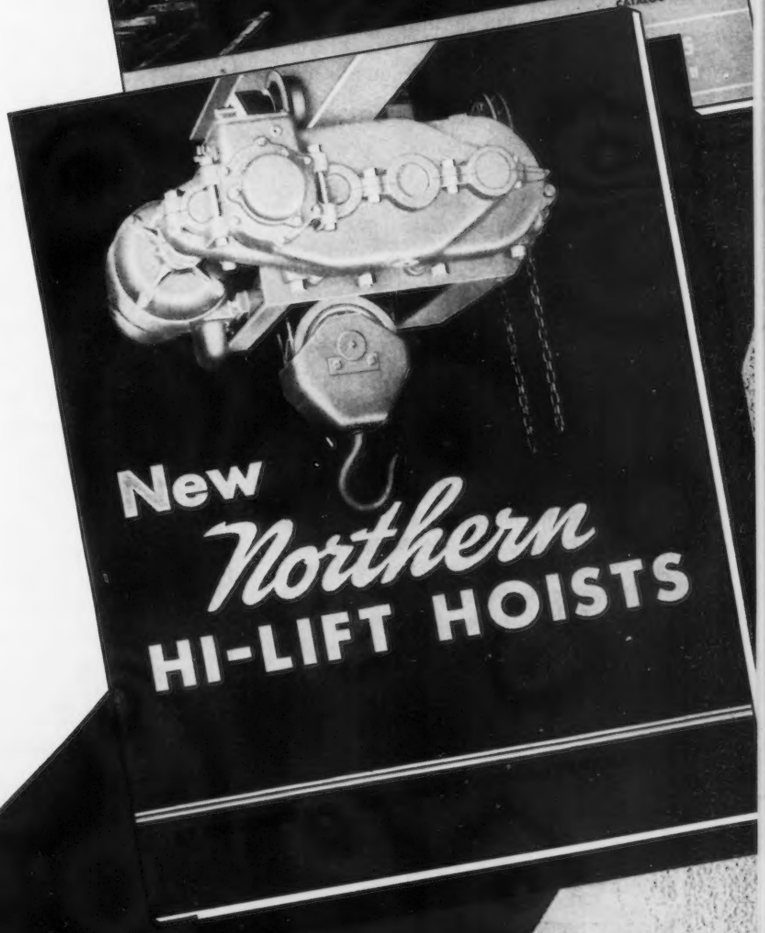

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This Industrial Week . . .

U. S. industry was attempting this week to show how swiftly free men can act in mobilizing the productive capacity of a democracy.

Since the early stage of modern warfare is a battle of materials before the war becomes a battle of guns and other weapons, the sharpest adjustments in the nation's new victory program fall, where one might expect, on the automobile industry.

This largest peacetime consumer of metals is confronted with a rapid series of orders which means that almost all of its peacetime plants must be closed immediately.

War Hits Auto Industry First

Typical of the drastic steps which all industry may expect from here on as a result of the new and dangerous war in the Pacific was the Office of Production Management order suspending output of passenger automobile tires until Dec. 22 while a comprehensive program for the rubber industry—facing a war threat to shipments from the Far East—can be worked out.

In another set of orders the OPM slashed the December passenger car quota 25 per cent, a reduction of 51,212 cars from the original December allowance of 204,848 cars. The January quota for passenger automobiles is 102,212 cars, a reduction of 75 per cent from last January's total.

Plant Shutdowns Come Quickly

Then the automobile industry announced through its manufacturers' association that it would accept "without reservation" these actions by the government. Shutdowns of automobile plants came quickly, with some General Motors units closing last Friday when Ford also announced all civilian production was suspended immediately. Chrysler plants are expected to go down Dec. 19, since this company had not yet exhausted its quota for the month.

At midweek the United Automobile Workers Union, which had been insisting on time and a half for Saturdays and double time for Sundays had agreed to arbitration of this point, a step which might help the upsurge in war production which is looked for from Detroit.

OPM Allocating Drum Stock

The contraction of the automobile industry's peacetime activities was reflected in other leading industries. Late last week and early this week the automobile companies were suspending all or almost all of their unfilled steel orders. The space made available on steel rolling mill schedules was immediately taken by highly rated defense tonnage. The OPM is already in the process of allocating heavy tonnages of drum stock for barrels which will crowd all strip mills. The strip mills are also likely to take even greater tonnages of plates and heavy sheets which have been taken from large plate mills which now must concentrate on Navy and Maritime materials.

Curtailment of civilian production, now in full swing, includes additional cuts in manufacture of washing machines and ironers of 5 per cent to 40 per cent below the monthly average sales in the 12 months ended June 30. The larger companies making these household items took the largest cuts and defense orders in this as in some other civilian industries, are expected to cushion effects of the reduction.

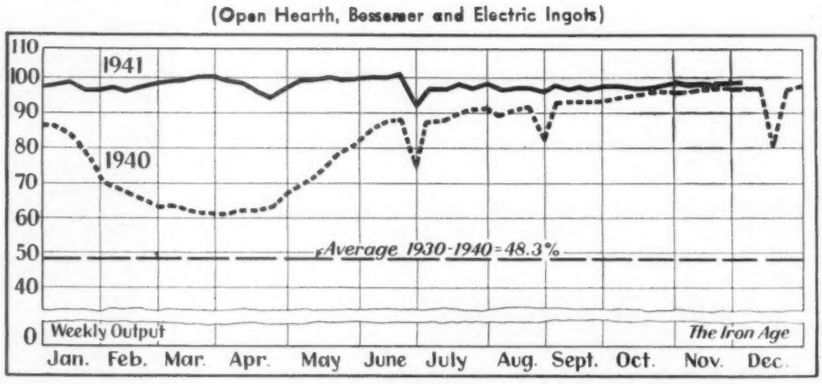
War Board for Rails Considered

Diversion of steel and other materials from peacetime plants to defense use is rapidly growing. At a meeting last week, railroad car builders were told they would get 107,916 tons of plates in December, a greater tonnage than for any other recent month. This step gains significance with the pressure on the country's transportation system as a result of breaking out of war in the Pacific. Two hundred locomotives, distributed among three manufacturers, were ordered recently for export. All will get an A-1-A priority rating as will 5000 railroad cars soon to be ordered for the Army for export. Included in this week's industrial news was a request to the Interstate Commerce Commission for a 10 per cent horizontal increase in freight rates for steel products and increased rates on coal, coke and iron, as a consequence of higher operating costs due to the recent railroad wage advance and other factors.

It is understood the entire transportation problem with respect to supplies and material in conjunc-

Steel Ingot Production—Per Cent of Capacity

(Open Hearth, Bessemer and Electric Ingots)



Steel Ingot Production, by Districts—Per Cent of Capacity

	Pitts-burgh	Chi-cago	Youngs-town	Phila-delphia	Cleve-land	Buf-falo	Wheel-ing	De-troit	South-ern	S.Ohio River	West-ern	St. Louis	East-ern	Aggre-gate
Current Week.....	97.0	103.0	97.0	90.5	100.0	92.5	86.0	106.0	98.5	103.5	97.0	108.0	109.0	97.5
Previous Week....	99.0	101.5	98.0	90.5	98.0	92.5	93.0	104.0	95.5	103.5	97.0	108.0	102.0	97.5

tion with the war situation may soon be expedited by the formation of an industry committee. It is said this may be composed of nine representatives from the railroads, four from contract car builders, two from locomotive makers, and five from railroad specialty companies. It is also understood that such a committee, if formed, will be representative of large, medium sized, and small companies, and will act in a consulting capacity to the OPM.

Seizure of Metal Stocks Possible

At midweek it was clear that stricter control over all inventories of strategic materials was likely to be accompanied by formal requisitioning of such materials when they are not being put to direct war use. OPM has had power to control stocks but has been slow to use this authority. Now, however, with the armament effort passing from the defense to the war stage, and with the Pacific war threatening supplies of tin, rubber, manganese, tungsten and other materials, defense officials may be forced to use their power to fill gaps in defense plant needs.

Defense leaders have appealed to American industry to comply "immediately and wholeheartedly" with all priority orders and requests for information issued by the OPM priorities division and other agencies. A few isolated refusals to report on inventories, needs and uses of certain critical materials brought a warning from Priorities Director Donald M. Nelson. One firm wired Nelson that "national emergency was no time to be asking for or filing reports" and the priorities director replied that the refusal was unwarranted and impeded the proper administration of the priorities system.

War Brings New Priority Actions

This week brought a new flood of priority actions, all of which are listed in this edition of THE IRON AGE. Buyers of steel plates were told, for example, that PD-73, regardless of allocation of plates, must accompany each plate order because the OPM needs more than ever the information carried on these forms. The priorities division, acting to kill one of the rumors growing out of war, announced that retail consumers cannot and must not be expected to produce preference rating certificates when placing normal orders for finished goods. This declaration was intended chiefly for distributers of metal products.

First development in the steel expansion situation to follow U. S. entry into a shooting war is the announcement by W. L. Batt, OPM director of materials, that steel plant expansion will now be pushed with new speed. High military ratings will be given these projects which, Mr. Batt said, should (1) increase pig iron capacity to balance present finishing facilities and to offset expected scrap shortages, and (2) increase electric furnace and other facilities to provide special treatment steels, alloy steels and specific steel products necessary for war production.

Ratings just below those given top military projects, said Batt, will push aside some of the problems ahead of quick completion of the present steel expansion plan. The OPM iron and steel branch is now gathering additional information on steel capacity and OPM will make detailed reports on steel to the Supply Priorities and Allocations Board.

Meanwhile the Office of Price Administration took a long expected step in freezing resale prices of steel at levels prevailing April 16, 1941. The order, effective Dec. 15, affects all distributers, dealers and jobbers, covering plumbing supplies, warehouses, hardware jobbers and dealers, industrial supply firms, and oil field suppliers. Every steel seller is required to maintain records of sales, inventories and orders for inspection of the OPA. Sellers whose annual gross sales exceed $50,000 annually are required to file prices in effect on April 16.

Considerable fluctuation in district steel production rates is reported this week, but the gains equalled losses, leaving the national rate, computed by THE IRON AGE, unchanged from a week ago at 97.5 per cent of capacity. While several of the larger districts attribute losses to scrap shortage, the tightness in pig iron is a factor retarding output in other areas.

The Pittsburgh rate this week is off two points to 97 per cent, while Chicago is up 1½ points to 103 per cent. Youngstown declined one point to 97, Cleveland rose 2 to 100 per cent, Wheeling lost 7 to 86, while Detroit moved two points higher to 106 per cent. The Eastern District was reported 7 points higher at 109.

Incoming orders for steel are fairly close to the November rates, although some mills report an advance of as much as 10 per cent. Many producers have been forced to turn away non-defense business, a step partly accounting for the leveling-off of orders. A large order has been placed for alloy steel bars to go into manufacture of shell caps. It is reported that the most promising steel shell casing that has developed thus far is one drawn from a forging.

Drive to Draw Scrap Begins

As the OPM opened an intensive campaign to draw scrap from households, stores and industrial plants, lack of scrap was reported to have caused the shutting down of some more openhearth furnaces. Further curtailments are likely. Success of the drive probably will have some bearing on the extent to which the government uses its powers to seize stocks. Appealing to all holders of surplus metals supplies, including scrap, Priorities Director Nelson last week urged that his office be telegraphed the amounts of inventories which can be spared to assist war production.

Fabricated structural steel awards for the week total 18,700 tons, and include 4800 tons for an addition to a tank plant, 3500 tons for buildings for an aluminum company, 1859 tons for a forge plant and 1300 tons for a Navy yard pier. New structural steel projects of 10,900 tons include 2700 tons for a construction trestle, 1720 tons for a machine shop and foundry and 141 tons for railroad bridges.

Among reinforcing steel awards of 20,000 tons are 5000 tons for a Navy yard dock, two piers and two pump houses, 4000 tons for a smokeless powder plant and 1675 tons for a power plant for a dam. New reinforcing steel projects call for 12,900 tons and include 3850 tons for a power plant, 3000 tons for oil storage facilities and 2750 tons for approaches to new defense bases.

News of Industry

o o o

STRIKE BAN: William Green, AFL president, posted this workers' pledge to do their duty "ten times over to smash Japan" on the door of his headquarters. Green asked that the AFL ban on strikes be made 100 per cent effective.

Auto Plants Swiftly Stilled by Series of Wartime Measurers

Detroit

• • • **Swiftly following** the United States' entry into the war last week came a series of orders in rapid succession affecting the automobile industry, largest peacetime consumer of metals. The sum total meant simply that the auto industry had to close all its civilian plants almost immediately.

First, and probably a key to interpretation of the future of the automobile industry, was an order drafted by OPM to suspend production of passenger automobile tires (and approximately 30,000 other nonessential products in which rubber is used) for about two weeks or until a comprehensive plan for the rubber industry can be worked out. Large truck tires and those carrying rating of A-3 or higher are excepted.

The last few hundreds of cars built last week came out of the plants with only four tires, no spare.

OPM banned on Thursday, Dec. 11, the sale of automobile tires and tubes until Dec. 22. The step was taken to stop a wave of buying by automobile drivers. The Rubber Manufacturers' Association Oct. 31 showed 4,122,836 tires on hand, a decline of 20 per cent from September stocks and a 56 per cent decline from the 9,409,683 casings on hand Oct. 31, 1940.

The second set of orders from OPM affected passenger car production. Effective Dec. 15, the December quota was trimmed 25 per cent. The January quota was cut 50 per cent. The revised maximums sliced 51,212 cars from the original December allowance of 204,848, cutting it to 153,636. The January quota is 102,424, a 75 per cent cut off last January's output.

Because the industry had crammed most of its December output into early weeks of the month in preparation for the shutdown to change over from bright work, it had completed approximately 188,195 vehicles by Friday night, Dec. 12, according to estimates by Ward's Reports, Inc., for the period Dec. 1 to Dec. 12. This total includes Army trucks and other trucks not covered by OPM quotas. All but about 30,000 of the new quota figure had been completed. On Monday, Tuesday and Wednesday of this week those 30,000 vehicles were to be manufactured. After that, all civilian production would be halted.

Shutdowns of auto plants were reported hourly on Friday. Some General Motors units closed their doors Thursday night, others quit Friday and the most optimistic expectation was that some would finish out the day on Dec. 16 while one or two plants might make a few cars on Dec. 17.

One exception to the early shutdown appeared to be Chrysler Corp., which intended to operate its final assembly lines, at least, until Dec. 19. Chrysler's division apparently had not exhausted its December quotas, even on the new curtailed basis.

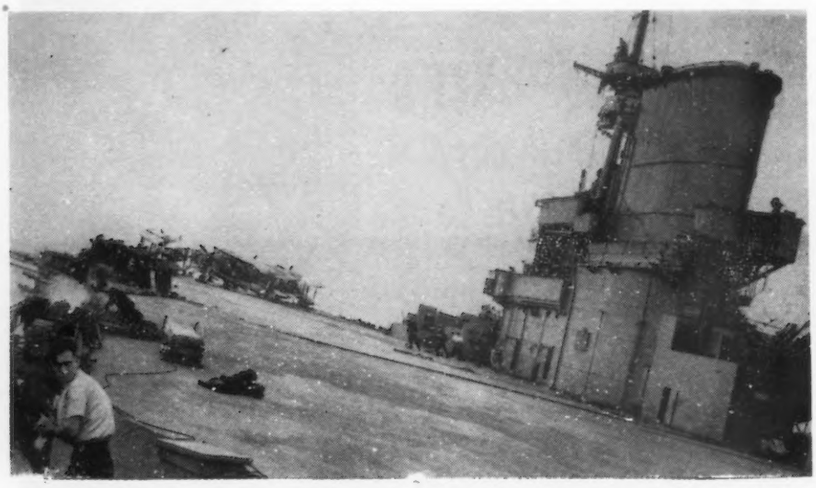
Ford announced last Friday that all civilian production was suspended immediately.

The industry, through the Automobile Manufacturers' Association's president, Alvan Macauley, announced it would accept without question the action of the government.

Seven-day operations do not exist yet in Detroit's production plants on defense work. The UAW appears to be on the point of making a concession in regard to overtime provisions. It had insisted on time and a half and double time for those who worked on Saturdays and Sundays, regardless of whether the 40-hour limit for any individual was exceeded. Its telegraphic offer to General Motors to accept arbitration on these points indicated that a face-saving solution was sought, but that the UAW would give in.

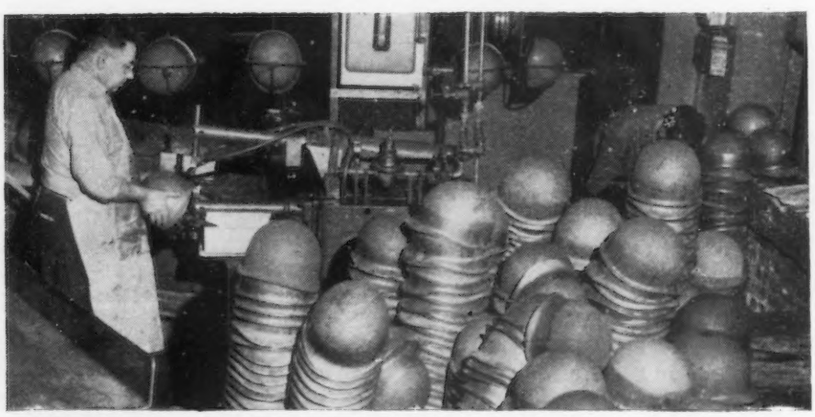
A few small plants which are ready to start seven-day operations report they are waiting for materials.

The first industrial plant blackout in the Detroit area was staged



MORTALLY WOUNDED: The heavy list on the flight deck of the sinking Ark Royal, Britain's aircraft carrier, as it sank following a torpedo attack east of Gibraltar on Nov. 14.

NEW BRITISH BOMBER: The "Avro" Manchester is one of Britain's latest contributions to the heavy bomber field. These flying battleships have taken part in many recent raids on Germany and occupied territory and now are out practically every night in the R.A.F. offense.



NEW ARMY HELMETS: McCord Radiator Co., Detroit, is making the new style helmet for the U. S. Army, which will replace the flat model used in the first World War. Here, the workman is welding a loop for the chin strap.

at the Ford Rouge plant last Thursday night for 10 minutes. The neighboring city of Dearborn cooperated. Twenty-four thousand Ford workers stood at stilled machines when the warning whistles blew at six p. m.

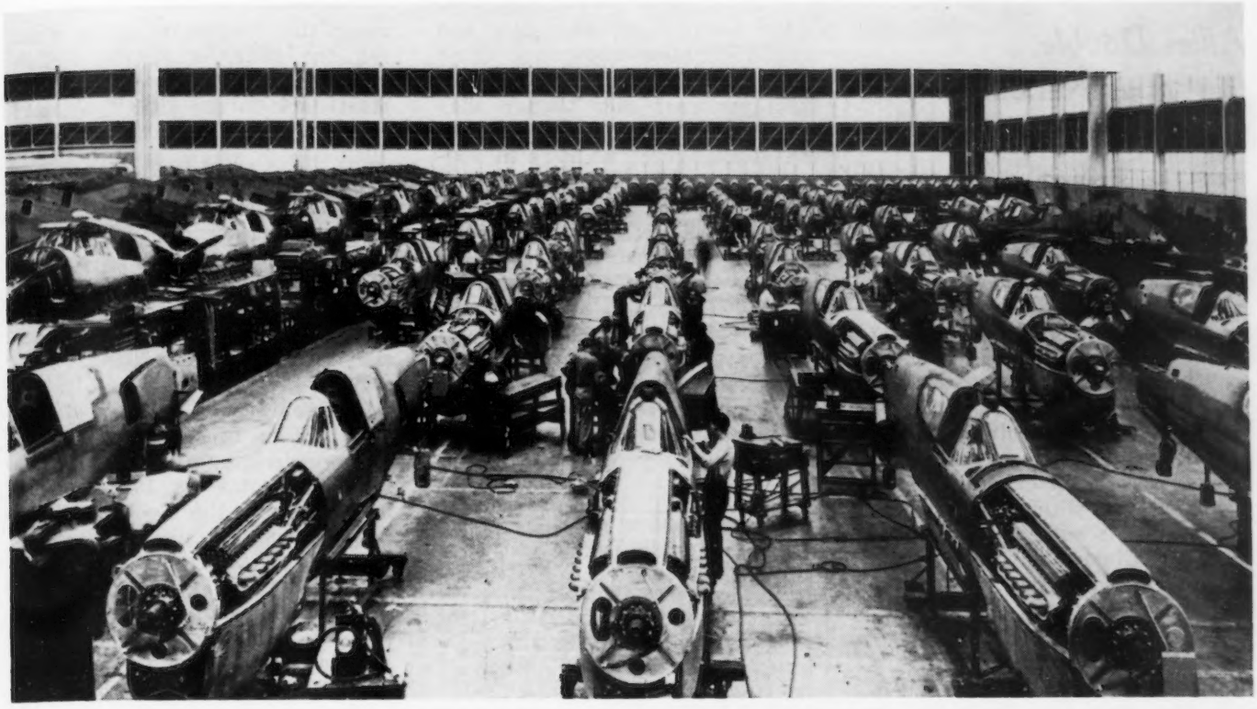
Thirty-nine per cent of all workers in the "potential defense industries" of the Detroit area are working on jobs contributing directly to the war program, according to the Michigan unemployment compensation commission. The rest of the workers face doubtful months ahead.

Civilian Items Restricted In New Canadian Order

Ottawa, Canada

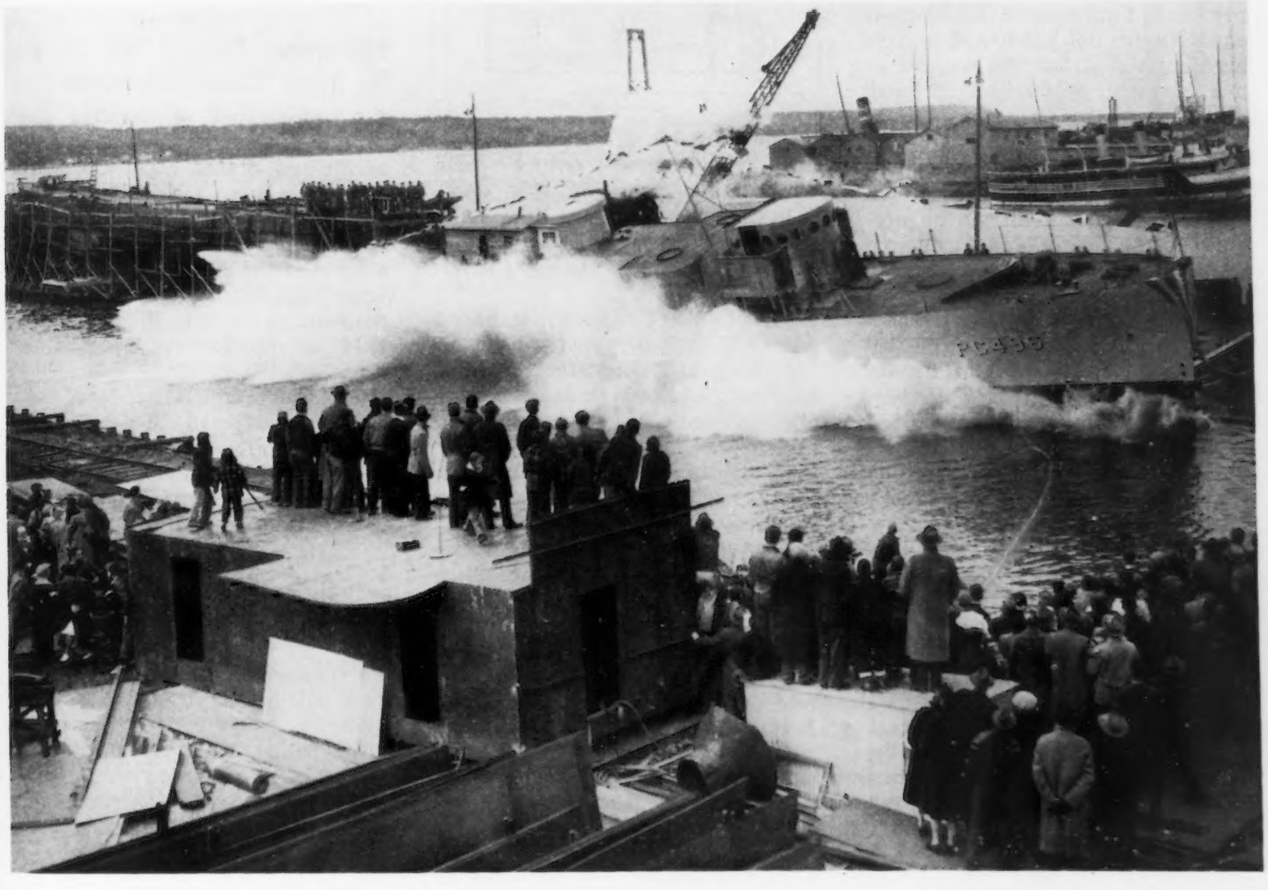
• • • **With the object** of conserving metals and labor, Alan H. Williamson, controller of supplies in the Department of Munitions and Supply, has placed new restrictions on non-essential production. The order goes into effect immediately and specially designates electric broilers, fans, grills, mixers, percolators, sandwich toasters and grills, stoves for glass coffee makers, electric tea kettles, toasters, roasters, grills, waffle irons and all other small electrical appliances for household use; all toys of metal of any kind, other than precious metals; bicycles, joycycles, tricycles, children's wagons and cars made of metal, ice skates and rollerskates. The order also covers spring-filled mattresses, bedsprings, upholstering springs, upholstered furniture in the making of which metal is used, commercial laundry and dry cleaning machinery, in the making of which metal is used. Other items include metal signs, metal and wire wastepaper baskets, metal and wire letter trays and metal and wire desk trays; metal smoking stands, metal novelties and ornaments, including metal ash trays and vases; metal counters, metal display stands, metal lockers, metal partitions, metal shelving, and metal storage cabinets; metal radiator covers; metal fencing; metal coffins or coffins in which metal is the chief component. All metal furniture is embraced in the order. Besides the articles specifically listed the order takes in hundreds of other small metal articles.

The Canadian Government also has frozen all stocks of rubber.



FIGHTER PLANES: At the Curtiss-Wright plants in Buffalo, 13 assembly lines are turning out P-40 pursuit ships in ever increasing numbers. At left is a line of Curtiss O-52 observation planes.

NEXT MOVE IS FORWARD: This submarine chaser will go forward when it sets out after Axis subs, but was launched sideways in Sturgeon Bay, Wis. This is the first of its type to be completed in this area, is 165 ft. long and all-steel welded. Leather Smith Coal & Shipbuilding Co. built it and has contract for six more. Four minutes after launching, the keel for another was being laid.



Allies Double Axis Nations In Steel Capacity

• • • **The strength** of the Allied nations—United States, the British Empire and Russia—in the basic material of war, steel, is estimated to be double that of the Axis powers. The Allies are estimated to control steel making capacity amounting to about 130,400,000 tons of ingots, as compared with 60,600,000 under Axis domination.

United States capacity for steel, which President Roosevelt has described as the backbone of the weapons upon which free government rests, is sufficient to enable it alone to turn out three tons of ingots for every two tons available for the Axis.

Should two-thirds of Russia fall under German control, the Allies would still be able to make 60 per cent more steel than the Axis, according to the American Iron and Steel Institute.

By the close of 1941, the American steel industry will have capacity for producing approximately 88,000,000 net tons of steel per year. Comparable statistics of capacity are not published by foreign countries, but the records of maximum production in peak years represent a measure of capacity.

According to the best information available, approximately 60,600,000 tons per year can be produced by Germany, Japan, and all continental European steelmaking nations except Russia.

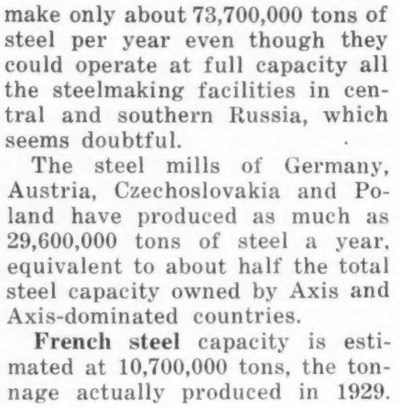
Steel capacity of the British Empire is approximately 20,600,000 tons a year, while that of Russia is about 21,800,000 tons. Together, the steel capacity of the United States, the British Empire and Russia is about 130,400,000 tons per year, or nearly 120 per cent more than that of the Axis.

About 60 per cent of the Russian steel capacity is believed to be located in the central and southern areas of that country, the Institute says. If Russia should lose the entire steel capacity of those areas, approximately 117,300,000 tons of steel could still be produced annually by the American and British Empire steel industries plus the remaining 40 per cent of Russian steelmaking capacity.

By comparison, the Axis and Axis-dominated countries could make only about 73,700,000 tons of steel per year even though they could operate at full capacity all the steelmaking facilities in central and southern Russia, which seems doubtful.

The steel mills of Germany, Austria, Czechoslovakia and Poland have produced as much as 29,600,000 tons of steel a year, equivalent to about half the total steel capacity owned by Axis and Axis-dominated countries.

French steel capacity is estimated at 10,700,000 tons, the tonnage actually produced in 1929.



In no succeeding year, however, did French steel output come within 12 per cent of that total. It is likewise necessary to go back to 1929 to establish peak production and probable capacity in Belgium, 4,500,000 tons.

Japan's steel capacity is about 7,100,000 tons per year, based on 1940 output. Italian steel capacity is about 3,000,000 tons, the production peak reached in 1939. Luxembourg's steel industry reached its maximum output in 1929, when 3,000,000 tons were produced.

The steel production of Hungary, Spain and Sweden probably should be considered as largely under Axis domination. Together those countries can produce about 2,700,000 tons of steel annually based on past performance.

Of possible significance is the fact that France, Belgium and Luxembourg, conquered by Germany in the 1940 campaigns, reached their peak of steel production in 1929, and failed to reach that level in any later year. On the other hand, Germany's steel production in 1935 was almost back to the 1929 level, and German output from 1936 through 1940 was in excess of 1929.

Similarly, the present estimated capacity of the United States, the United Kingdom and British Dominions, and likewise Russia is much greater than in 1929. American steel capacity, for example, will by the end of 1941 be 20 per cent greater than in 1929.

Steel production in the United Kingdom reached a peak of 15,100,000 tons in 1939, and is said to have dropped only slightly below that total in 1940 despite bombings and the blockade. Canada and South Africa are each establishing new production records in 1941 as Canada produces 2,600,000 tons and South Africa 400,000 tons.

Data for 1941 are not available for Australia and India, but in each case the output of steel in 1940 represented a new peak. Australia produced 1,300,000 tons last year, and India 1,200,000 tons. The Russian steel industry achieved its maximum recorded output in 1940.

November Record Set By Steel Corp. Shipments

• • • **Shipments of finished** steel products by subsidiary companies of United States Steel Corp. for November were 1,624,186 net tons, a record for the month, compared with 1,851,279 net tons in October, a decrease of 227,093 net tons, and with 1,425,352 net tons in the corresponding month in November, 1940, an increase of 198,834 net tons.

For the year 1941 to date, shipments were 18,612,901 net tons, an all-time high, compared with 13,431,487 net tons in the comparable period of 1940, an increase of 5,181,414 net tons.

6 Cargo Ships Awarded Bethlehem-Sparrows Point

Washington

• • • **Approximately** 23,000 tons of steel will be required for the construction of six export type cargo ships to be built by Bethlehem Steel Co. at its Sparrows Point, Md., yard under a contract made last week with the Maritime Commission.

Freight Car Output Drops in November

• • • **Freight car** construction in contract shops fell to 6201 cars during November from the October total of 7045 domestic and export cars. The contract shops operated at 44 per cent of rate capacity and 60 per cent of practical capacity during November.

Total output of the shops for 11 months of 1941 was 58,136 cars, or 37 per cent of rated capacity and 56 per cent of practical capacity.

With transportation becoming one of the all important factors for carrying on the war, it is expected that out of last week's railroad meeting in Washington between railroad officials, car builders, and OPM, will come

Freight Car Building Activity

October and November, 1941
(Railroad Car Shops Not Included)

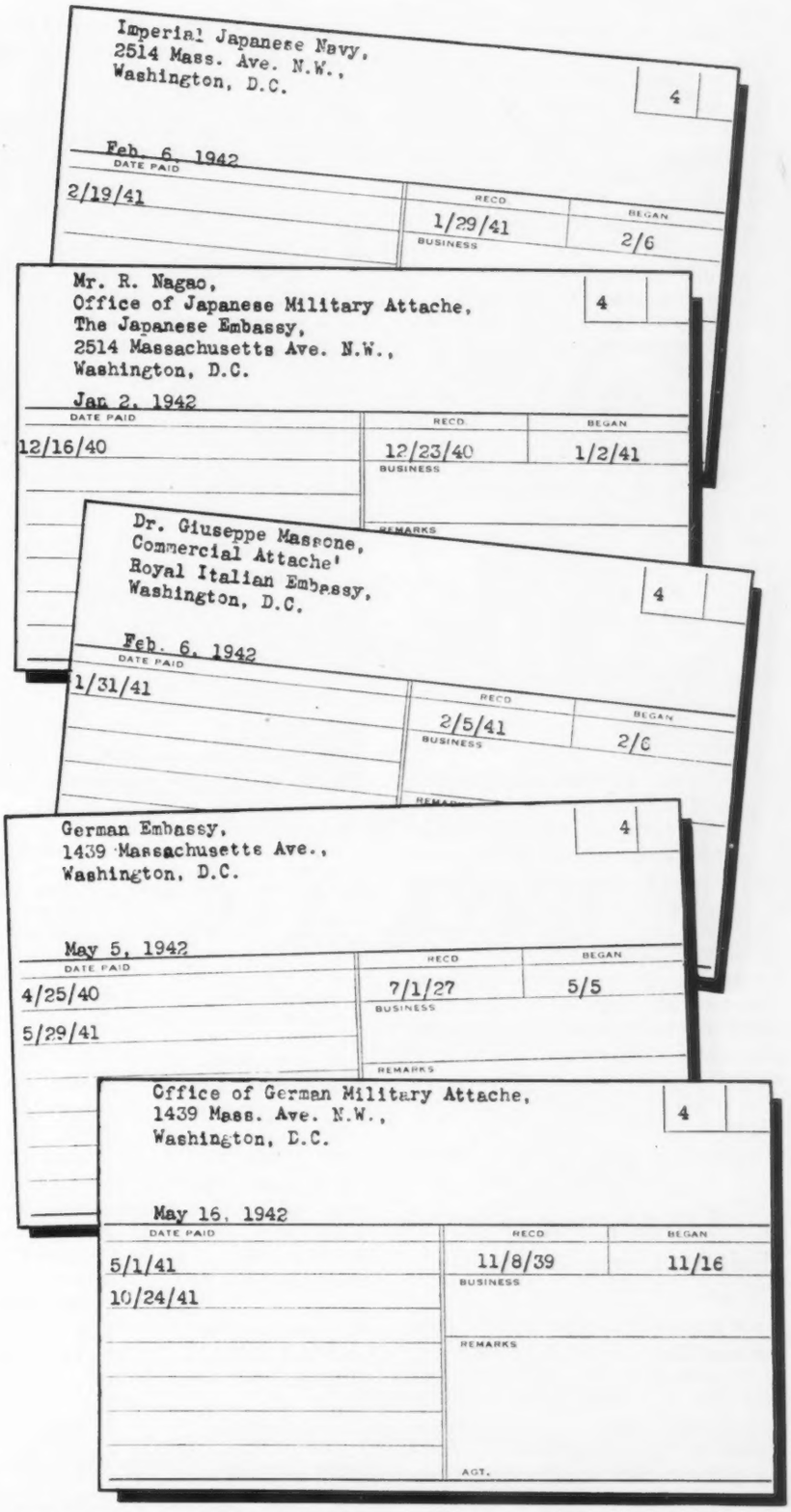
Company	November	October	Monthly Capacity
American Car & Foundry Co. ..	925	1,699	4,775
Pullman Standard Car Mfg. Co....	2,091	2,304	4,000
Pressed Steel Car Co.	....	567	1,350
General American Transportation Corp.	837	767	1,300
Greenville Steel Car Co.	212	200	400
Bethlehem Steel Co.	692	620	800
Virginia Bridge Co.	12	0	300
Ralston Steel Car Co.	228	75	500
Mt. Vernon Car Co.	260	240	350
Pacific Car & Foundry Co. ...	147	223	250
Magor Car Co. ..	143	350	300

Freight Car Production

(Carbuilding Plants Only)

	Cars Produced	Per Cent of Capacity Rated*	Per Cent of Capacity Practical†
January	5,009	36	49
February	4,122	29	40
March	5,022	36	49
April	5,563	40	54
May	5,086	36	49
June	5,143	41	50
July	5,391	39	53
August	3,886	28	38
September ...	5,668	40	55
October	7,045	50	68
November ...	6,201	44	60
11 months..	58,136	37	56

*Based on 14,000 cars a month capacity.
†Based on 10,300 cars a month capacity.
Note: Above production figures also include cars made for export as follows: January, 16; February, 65; March, 35; April, 148; May, 550; June, 6; July, 100; August, 30; September, 624; October, 425; November, 217. Total, 11 months, 2186.



IRON AGE "CASUALTIES"—Shown above are IRON AGE circulation cards of representatives of JIG powers (Japan, Italy and Germany) swept out of THE IRON AGE list of subscribers by last week's declarations of war. Careful readers of this publication to determine the progress of the U. S. defense program, were from top to bottom, the Imperial Japanese Navy, the Office of the Japanese Military Attache, the Italian military attache, the German embassy and the Office of German Military attache.

allocations on transportation material.

For the first 11 months of this year, railroad shops and car builders have not operated anywhere near capacity because of lack of plates. Emphasis on plate production for naval and maritime ships has prevented fulfilling of car builders' needs and tremendous backlogs of unfilled orders still exist. Coupled with this are high priority ratings on lend-lease material, an example of which is 5000 freight cars to be allocated soon for export with an A-1-A rating. Allocation of 200 locomotives ordered for export has already been made as follows — 70 to Baldwin Locomotive, 70 to Lima Locomotive and 60 to American Locomotive. These carry an A-1-A priority.

Slag Data Win Award for Pipe Mill Official

Pittsburgh

• • • **Louis F. Sattele,** superintendent of pipe mills at the National Works of National Tube Co., McKeesport, has been notified by the American Institute of Mining and Metallurgical Engineers that he has been voted the J. E. Johnson, Jr. Award for 1941, for his development and practical application in blast furnace operation of fundamental slag data. The award will be presented at the annual meeting of the Institute in New York Feb. 11, 1942.

Less Sulphur in Shell Steel Likely by Change in Specs

Chicago

• • • **Reports here of a** change in the specifications of shell steel are to the effect that the sulphur content will be lowered starting the first of the year. This will make machining harder and will possibly present new tooling problems in the machine tool picture, where the biggest headache for some time has been the matter of small tools. The reported change is still in the rumor stage but informed sources are of the opinion that it will definitely be done.

FOLLOWING THE PLANS: At the Cadillac plant making Allison engines, each operator is given an "information Sketch," on which the entire operation is diagrammed. Changes are called to the attention of the operator by giving him a new sketch. Here an operator is checking the size of the hub of an Allison engine gear blank.

Aircraft Valve Plant Open

• • • **Production** at the new $13,000,000 plant of Thompson Aircraft Products, Inc., subsidiary of Thompson Products Co., aircraft and automotive valve firm, has been under way for several weeks, starting less than seven months after ground was broken for construction. The plant is expected to turn out $2,500,000 worth of aviation parts a month by next Spring.

New Contract Office Opens

• • • **New quarters** for the Division of Contract Distribution branch serving Pittsburgh and Southwestern Pennsylvania will be opened at Room 405, Fulton Bldg., Pittsburgh, telephone number Grant 3790, on Dec. 17.

Determination to Win Is Strong in Chicago Area

Chicago

• • • **Industry in this section** was calmer after the first full week of war than it had been after more than a year of defense preparations. Coupled with this calmness was a great change in general feeling, with industrialists determined to swing every ounce of productive strength to war manufacture.

Steel people here see an extremely tight situation in larger sizes of bars because of the heavily increased shell program. A number of bar mills will have to take on sizes they have shied away from in the past. There will be as much scrambling on bars as there is in plates. In this connection, it is reported that a change in shell steel specifications definitely will go into effect the first of the year.

It is predicted here in some quarters that implement makers will be hit hard. Since bar production will now be directed to shells, the farm products will be deprived. Fortunately, the industry has obtained rich slices of armaments contracts in the midwest and it will generally be in good position to take on more.

Scrap supplies are now at their lowest ebb and operating executives feel that soon steel output will be lower. The two largest steel mills have asked for allocations of scrap. A third is so close that it may have filed a similar request by the time this appears. Biggest fear, of course, is that allocations cannot be continued forever. The first mill to be given scrap in this district was unable to start up the open hearths it had closed, despite the allocation. Perhaps the best examples of the situation are shown by these two cases. One scrap broker spent five hours out of one working day arranging the sale of two cars of scrap. Another broker was asked to accompany a mill representative on a trip to the west to look for scrap. The supplies obtained were not enough to pay expenses for the week's trip.

Small manufacturers in this entire area are now rushing to get war contracts. Many of them

have surprisingly good stocks of materials much of which can be used on war work. In less than a week the mid-west complexion changed from a questionable attitude toward the threat of war to an all out, "Let's get this job done quickly and right."

Steel and Iron Output in Canada Shows Wide Gains

Toronto

• • • **By means** of plant additions, the primary iron and steel industry of Canada, since the outbreak of war, has been increased by approximately 25 per cent, while the actual production of pig iron this year shows a gain of 88.8 per cent over that of 1939, and steel 81.4 per cent above 1939. Today Canada has a rated pig iron capacity of approximately 1,820,000 gross tons per annum, against the 1939 rate of slightly over 1,450,000 tons per year. The rated capacity for steel ingot production is upwards of 2,550,000 tons per year against the pre-war total of about 2,000,000 gross tons.

Pig iron production now is 94 per cent capacity.

Open hearth furnaces are reported at capacity production insofar as supply of raw materials are concerned. The production of pig iron today falls far short of taking care of all steel mill requirements and providing iron for merchant melters. On this account foundry and malleable grades come under strict supervision of the steel controller and supplies, on his approval, are made available only to those melters that are directly engaged in war work. Another, and possibly the most important handicap to increased steel production in this country is a shortage of steel scrap. While there has been no curtailment in operations to the present, steel mills and electric furnace operators are experiencing more difficulty almost daily in picking up new supplies. During the past year practically all dormant stocks of scrap have been cleaned up and passed along to consumers, and with the exception of war plants production of scrap has dropped sharply from pre-war days.

OPM Lists Forms and Orders That May Be Reproduced

• • • **OPM has issued** the following announcement describing what priority orders and forms may be reproduced. It is stressed that forms and orders may be reproduced only in accordance with the following instructions.

Any application form, including form PD-1, may be reproduced.

Any report form, including inventory report forms, may be reproduced.

Any "M" order, "L" order, or "E" order may be reproduced.

As to "P" orders, two rules are to be followed:

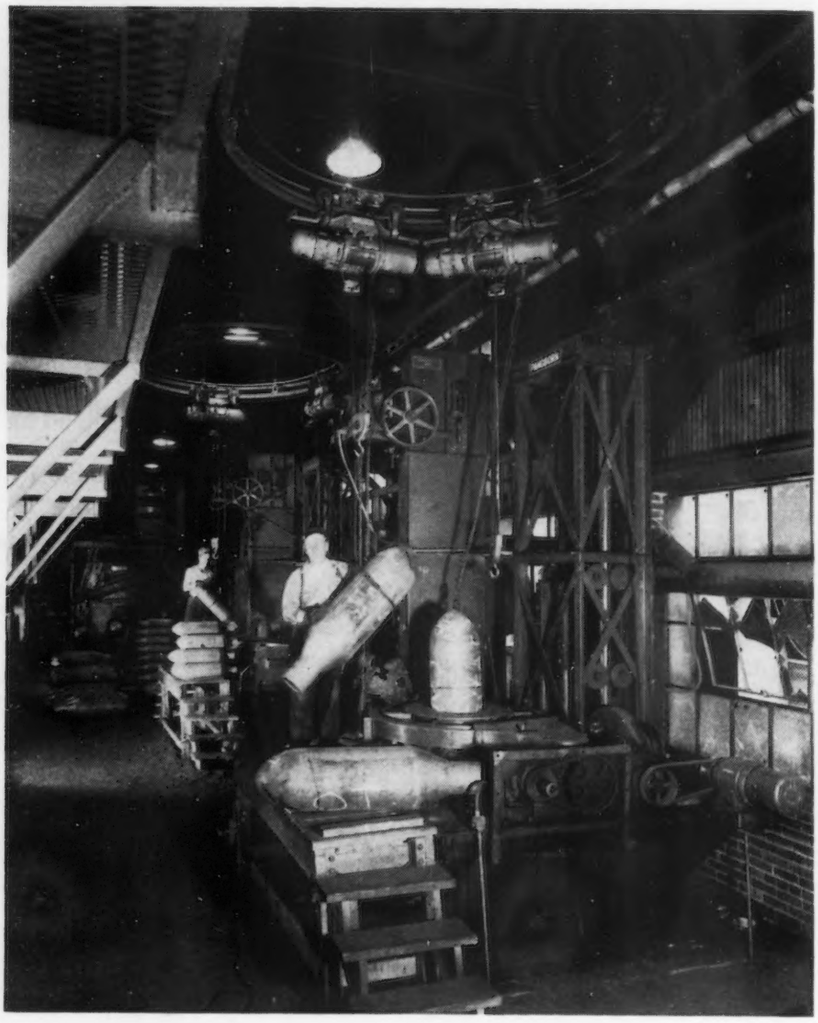
(1) If the order is issued to a general class of persons, and does not name any individual as the recipient of the order (as is the case in P-22, the maintenance and repair order) the order may be freely reproduced in the same manner as "M" orders.

(2) If the "P" order has been issued for the use of specifically named firms or individuals, it may be reproduced for use either by the individual producer or by his suppliers who are entitled to use the order, by the photo-offset or similar photographic process. Such copies must be identical in size and every other respect with the order as issued by OPM. Blank forms of "P" orders may be reproduced for informational purposes only when they are stamped "Specimen" or "Sample," so as to make it clear that the copy is for information only and not for use.

The purpose of these rules is to permit reproduction of forms and orders for (1) informational purposes, of (2) for purposes of applying for priority assistance or (3) furnishing information to the OPM—but also to prevent reproduction of form and orders which might lend themselves to improper use.

Whenever any form required by the OPM is reproduced, for whatever purpose, it must be reproduced in the exact format, language, color, type, size, and phraseology of the original.

SPECIAL HANDLING: These 500 lb. demolition bombs must be thoroughly cleaned inside and out to pass inspection by the Army Air Corps. The interior is cleaned in a special Pangborn unit that plays a stream of abrasives on the interior surfaces, and an airless Pangborn Rotoblast unit is used in cleaning the exterior surfaces.



Car Shops Get 107,916 Tons Of Steel Plates This Month

Washington

• • • **Railroad car builders** were told they would get more steel plate beginning in December than they have received in the past three months, as a comprehensive program of steel supply for manufacturers of locomotives, car builders, and railroad appliances was laid down here Dec. 12 by OPM. At the same time locomotive manufacturers told OPM they could comply with the Budd plan of 900 engines by Oct. 1, 1942, provided materials were made available.

OPM officials said that since the preference rating and the priorities system had failed to enable manufacturers to expand to keep pace with defense needs, a month to month allocation system for all steel supplies would be substituted. Plates have been allocated for some time. Monthly requirements are to be submitted on the 15th of every month of the next quarter to permit OPM to assure producers of adequate supplies. Priority ratings are merely to serve as a gage for allocations or be permissively used after monthly allocations are exhausted, in lieu of requests for supplemental allocations.

Exceeding tonnages of the previous three months, 107,916 tons of steel plates were allocated to car builders for December. November allocations totaled 94,764 tons, those for October were 100,382 and the September distribution was 91,000 tons.

Railroads Ask 10% Rise In Rates to Balance Costs

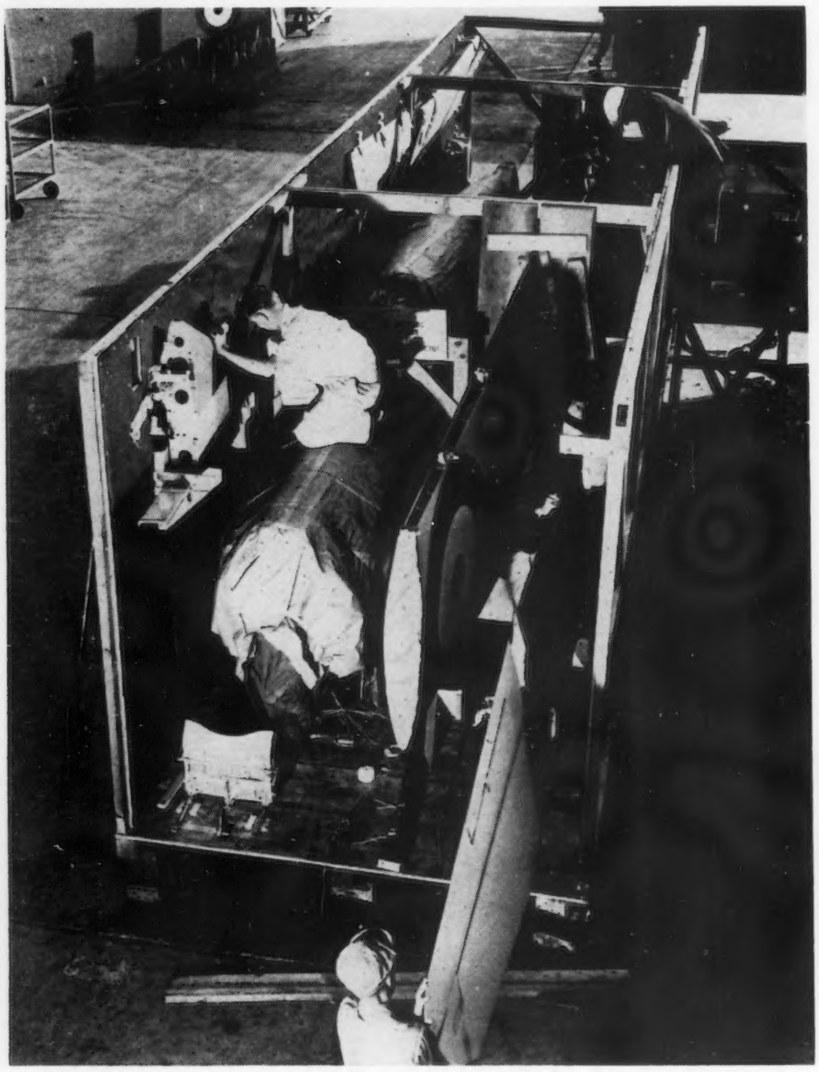
Washington

• • • **Freight rates** on steel products would be given a 10 per cent horizontal increase, and rates on coal, coke and iron would be raised on a proportional basis if the Interstate Commerce Commission grants a petition filed with it last Saturday for Class I railroads by the Association of American Railroads. The carriers asked for the increase in order to enable them to meet the recent wage increase and other costs. The petition calls for increases in all passenger and freight rates, and asked that they be granted promptly.

In the case of anthracite and bituminous coal, the petition asked for an increase of 5c. in rates stated on a net ton basis and 6c. where stated on a gross ton basis except that rates from all origins west of Chicago and Milwaukee would be increased from 3c. to 10c. For coke, the proposed increase is the same as that asked for bituminous coal.

For iron ore, an increase is proposed of 6c. per gross ton for the entire Western District plus one cent dockage at upper lake points; an increase of 6c. per net ton in the Southern District, and an increase of 4c. per gross ton on all rates plus one cent in the lake terminal charge in the Eastern District.

BUNDLE FOR BRITAIN: Workmen "wrap up" a very welcome Bundle for Britain, a North American "Mustang" fighter.



Record Ordnance Purchases Made in Week Before War

• • • During the week ended Dec. 8, the day war with Japan was declared, the Army's Ordnance Dept. announced the award of 438 orders, a new high. For more than a year, the Ordnance purchases have been increasing gradually week by week, with larger amounts involved, more companies participating, and a bigger variety of items. Almost all of the 438 orders for Dec. 1-8 were for metal goods, and are listed this week in THE IRON AGE's Government Awards column.

Factors Retarding Output Discussed in New Booklet

• • • **The annual rate** of American armament production effort still falls six to twelve billion man-hours short of the effort needed to close the gap between Axis and British war production, according to a study by Farrel-Birmingham Co., Inc., Ansonia, Conn. The yearly rate of defense production at the end of July, according to the authors, approximates five billion man-hours of factory effort, as compared to an estimated need of eleven to seventeen billion man-hours yearly. The new study, in booklet form, points out three factors retarding American war production.

Output of Steel Lower On Per Man-Hour Basis

• • • **A decrease** in output of finished iron and steel products per man-hour has resulted from the necessary hiring of 66,000 new wage earners by the steel industry between the last quarter of 1940 and the third quarter of 1941, it is shown by a recent study by the American Iron and Steel Institute.

The total tonnage of finished products produced rose to new high levels between the two periods despite the over-all decline in output per man-hour. The decline reflected mainly the hiring of relatively inexperienced men.

In the final quarter of 1940 the industry employed an average of 513,000 wage earners.

Lebanon Offers 30 Years Experience . . . and More Than 30 Alloys for Steel Castings

ON DECEMBER 11, 1911, the Lebanon Steel Foundry was organized by the two men who still head it—W. H. Worrilow, President and T. S. Quinn, Treasurer. Lebanon's thirty-year study of foundry practice (domestic and European) . . . Lebanon's thirty-year development of alloys for wider and wider ranges of casting application . . . today make Lebanon the choice of those who insist on fine craftsmanship and expert design.

The famed Circle Ⓛ now marks castings made in more than thirty different alloys. These Lebanon Steels cover a broad range of applications in many fields.

The right men using the right methods for the right kind of American defense—that is the immediate picture at Lebanon. Meanwhile, Lebanon metallurgists are studying future applications for stainless steel castings . . . and are ready to discuss significant developments with forward looking organizations.

LEBANON STEEL FOUNDRY • LEBANON, PA.

ORIGINAL AMERICAN LICENSEE GEORGE FISCHER (SWISS CHAMOTTE) METHOD

LEBANON *Stainless and Special Alloy* **STEEL CASTINGS** CIRCLE L

Resale Prices of Iron, Steel Products Are Frozen by OPA

Washington

• • • **Declaring that** the object is to end profiteering which has developed in the trade, OPA on Monday froze and made immediately effective resale prices of iron and steel products in quantities normally handled by jobbers, dealers and distributors at levels prevailing April 16, 1941. This price ceiling was fixed in Price Schedule No. 49. Price Administrator Leon Henderson said leading jobbers have "cooperated admirably" in keeping their prices in proper relation but that certain others have profiteered. He declared manufacturers urgently in need of steel have been forced to pay prices from 50 per cent to 200 per cent and more above normal.

The schedule forbids a resale by anyone at a higher price than the ceiling. This provision extends the scope of the schedule over various businesses which distribute iron and steel products in the course of their general operations. Plumbing supply houses, hardware jobbers and dealers, industrial supply firms, oil field suppliers and mail order houses are in this category. To exclude resales of small quantities by hardware stores and other retail outlets, the schedule provides that the maximum prices do not apply to sales of iron and steel by retail merchants in quantities smaller than those which jobbers, dealers or distributors normally deal in or quote prices on. Individuals or companies processing stocks of steel must conform to the price ceiling upon any resale.

It is estimated that about 11,800,000 net tons of iron and steel will be distributed by some 25,000 jobbers, dealers and distributors in 1941 against 6,686,000 tons in 1940.

To fix prices at the April 16 level, the schedule uses the price lists for heavy line and merchant wire products publicly circulated in the trade by leading distributors in 23 cities or metropolitan free delivery zones. Separate sections explain the methods by which maximum prices are to be computed under various circumstances, such as sales on the Pacific Coast for export and for specific products such as nails, annealed smooth wire and galvanized smooth wire, pipe and tubing.

A seller located in any city or free delivery area may not charge more than he charged on April 16, but sellers in "listed cities" whose April 16 prices were below those of the published listed prices applicable to such "listed cities" may apply to OPA for permission to adjust their prices upward to the "listed prices." Provisions are made to calculate maximum prices for sales in places other than the "listed cities," for sales by persons having no prices on April 16 and for "dislocated tonnage."

In the case of resales in the Pacific Coast states of California, Oregon and Washington, the schedule permits the addition of 35 cents per 100 lb. to the April 16 prices for a restricted list of products. As yet no special provision has been made for sellers at Gulf ports. Export sales cannot be priced above the maximum domestic price, f.a.s. port of shipments but on sales made by export brokers an addition of $3 per ton is permitted on less-than-carload lots.

Prices in excess of mill prices established in Price Schedule No. 6, covering iron and steel products, cannot be charged for direct mill shipments of any quantity; for shipments of any quantity diverted from delivery to warehouse; or for shipments of any quantity not put through the operation commonly known as "warehousing." Carload shipments out of warehouse stock made up of a variety of items cannot be sold above the maximum delivered price for a 500 lb. quantity, minus a discount of less than $7 per net ton.

Mixed carloads of merchant wire products, however, cannot be sold above the published mill base prices set forth in Price Schedule No. 6, but sellers in this case are allowed to retain the regular jobber allowance given by mills. A similar provision is made for sellers of mixed or straight carloads of pipe and tubular products, with a special exemption for sellers of oil country tubular goods out of distributers' stocks.

Records on any sales of 40,000 lb. or more of any wire or steel products to a single customer in any calendar month must be filed with OPA on or before the 15th day of the following month. This record must include a sworn statement giving the names and addresses of the buyers, the product and quantity sold, and the price for each quantity.

Further Cuts in Auto Quotas By OPM Seen Possible

Washington

• • • **Cuts of** 25 per cent for December and of 50 per cent for January made in passenger car and light truck production quotas by OPM's Division of Civilian Supply may be further readjusted downward as demand for defense steel and other critical materials become increasingly pressing. This was made clear by Leon Henderson, division director, in announcing last week further curtailment in the output of these automotive units.

"I want to emphasize again," said Henderson, "that there is no guarantee that sufficient materials will be available to permit manufacturers to achieve the maximum production permitted."

This current month's curtailment took effect Dec. 15 and means a reduction of 51,212 passenger cars from the quota of 204,848 cars fixed for the entire month. In January, 102,424 cars will be cut from the quota of 204,848. Passenger car output in December, 1940, was 396,823 and in January, this year, it was 418,350.

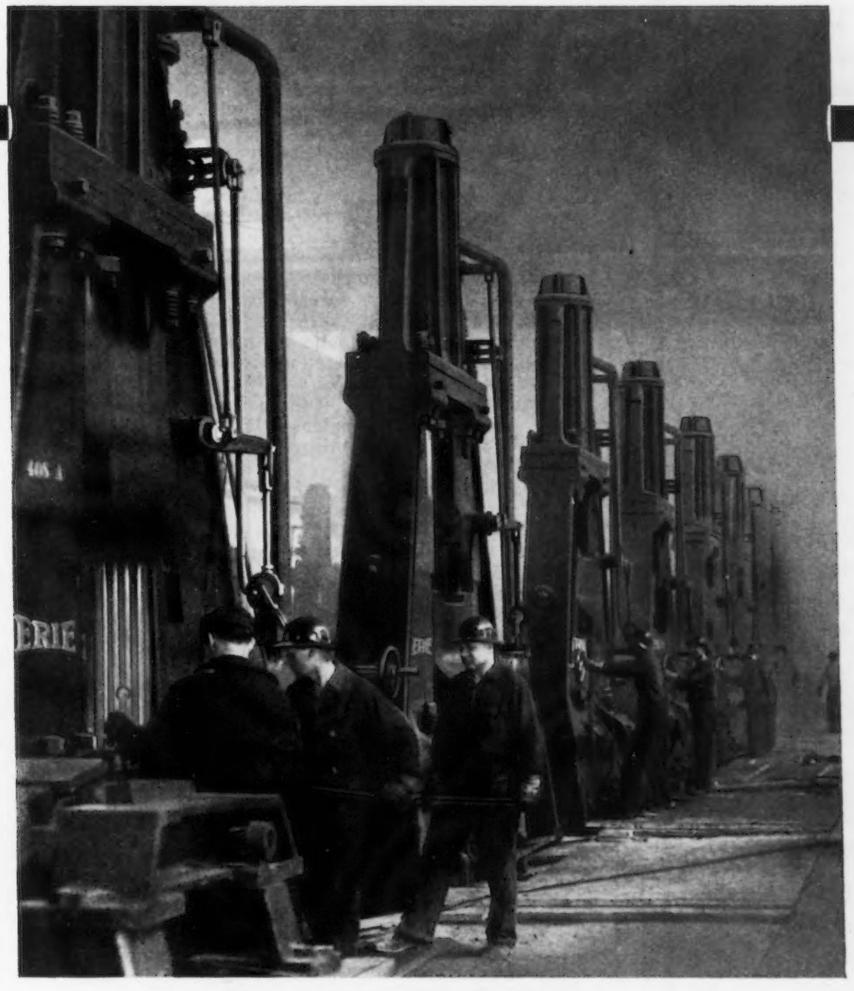
Production of trucks of less than one-half ton capacity was cut by 6042 from the quota of 24,169 established for December and output in January will be reduced by 12,084.

Meanwhile, the Automotive, Transportation and Farm Equipment Branch is undertaking a study of the industry's problems to determine how production will be affected beginning Feb. 1. The fact that this study is being made gave color to reports that, as sharp as they have been, cuts so far made in passenger car and light truck production are mild when compared with what may be forthcoming.

This was reported to have been indicated in a discussion of the increased emergency curtailment program at a meeting with manufacturers and representatives of labor held a day previous to the announcement of the new quotas.

INDUSTRY-WIDE STANDARDIZATION ON ERIE HAMMERS

In The Nation's Aluminum Forge Shops



ALUMINUM forgings are playing a stellar role in the Nation's defense program because they combine the lightness of aluminum and the added strength and ruggedness inherent to all forgings. Most of the aluminum drop forgings used in National Defense are being produced on Erie Hammers; for all of this country's aluminum forge shops are practically 100% Erie Hammer equipped.

This industry-wide standardization on Erie Hammers is proof of their *dependability* under abnormally heavy operating schedules—a highly desirable characteristic in any forge shop.

ERIE FOUNDRY COMPANY
ERIE, PENNSYLVANIA, U.S.A.

DETROIT
335 Curtis Bldg.

CHICAGO
549 Washington Blvd.

INDIANAPOLIS
335 Postal Station Bldg.

FRANCE
Fenwick, S. A.

CANADA
John Bertram & Sons Co. Ltd.

ENGLAND
Burton, Griffiths & Co., Ltd.

ERIE

ERIE BUILDS *Dependable* HAMMERS

THIS WEEK'S

Prices and Priorities

Ferroalloy makers advise OPA that present prices will rule in first quarter of 1942. Agreement covers ferromanganese, ferrosilicon and silico manganese. Southern, high-cost producer, quoting $25 above market asked to reduce price to $135. (OPA:PM1769)

Alcohol, butanol and acetone producers requested not to quote prices for delivery beyond Jan. 1, 1942. (OPA:PM1787)

Passenger car quotas for December and January set at 204,848 units. Light truck quotas set at 24,169 units. February passenger car allotments revoked pending further study. (OPM:PM1772)

Rubber use curtailed in order M-15-b, effective Dec. 11. Sales of automobile tires prohibited from Dec. 11 to 22, except on ratings of A-3 or higher. (OPM:PM1758)

Lead scrap and secondary material ceiling prices to be established shortly. (OPA:T97)

Copper and copper alloy product makers, affected by order M-9-c, permitted to use, to a limited extent, inventories of partially fabricated metal between now and March 31, 1942. (OPM:PM1718)

Automobile bright work ban officially postponed to Dec. 31, and certain parts exempted. (OPM:PM1742)

Electrodes are not covered by order P-39, according to official announcement. (OPM:T93)

Public utilities forbidden to undertake expansion without OPM permission in amendment to order P-46 issued Dec. 11. (OPM: PM1741)

Requisitioning of materials and supplies for war work to be expedited by new OPM division. (OPM:PM1739)

New York office established by OPA at 122 East 42nd Street. (OPA: PM1740)

Weighing, amusement and gambling machine production curtailed, and in some instances completely prohibited, in limitation order L-21 issued, Dec. 10. (OPM:PM1737)

Sitka spruce producers asked to discuss prices with OPA. (OPA: PM1757)

Glycerin producers, refiners, jobbers, dealers, requested to make no shipments other than for direct defense use or to prevent immediate shutdown of a civilian plant. (OPM:PM1756)

Flashlights, batteries and bulbs placed under a formal price ceiling in schedule No. 48 issued Dec. 10. (OPA:PM1744)

Petroleum industry supply houses assigned rating of A-8 for specified material in order P-83 issues Dec. 8.

Old rags placed under formal price ceiling in schedule No. 47 issued Dec. 6.

Mining machinery and equipment order P-23 extended to Dec. 31, 1941. (OPM:T94)

Warehouse prices of iron and steel products frozen at levels prevailing April 16, 1941, in price schedule No. 49 which became effective Dec. 16. Order covers all distributors, jobbers, dealers, etc.

Stove, range, other domestic cooking appliances output curtailed by order L-23 issued Dec. 13. All bright work use banned. (OPM: PM1801)

Insecticides, germicide and fungicide manufacturers assigned A-10 rating for obtaining scarce materials in order P-87 issued Dec. 13. (OPM:PM1792)

Priority field offices opened at El Paso, Texas, and Tampa, Fla. (OPM: PM1790)

Shellac and natural resin prices stabilized at prices prevailing Dec. 5. (OPA:PM1804)

Industrial explosive makers assigned rating of A-8 for production and packaging material in order P-86 issued Dec. 12. (OPM:PM1783)

Iridium and its alloys may be used by jewelry industry only on specific permission of OPM, according to order M-49 issued Dec. 12. (OPM:PM1771)

Washing machine and ironer output for February further curtailed by supplementary order L-6-a issued Dec. 12. (OPM:PM1780)

Inventory and Requisitioning Section established by OPM to control stocks. (OPM:PM1739)

For copies of above announcements address defense agency concerned, at Washington, giving announcement number as shown in parentheses after each paragraph. (For example, OPM:PM1500 *means announcement* 1500 *issued by Office of Production Management).*

Revisions for The Iron Age Priorities Guide

• • • Following revisions are to be made to THE IRON AGE Priorities and Allocations Guide published in the issue of Nov. 27.

Under "P Orders," page 4, add:

P-83—Material for supply houses in petroleum industry (12-8). Related form, PD-82-a.

P-46—Amendment (12-11). Prohibits public utilities from expanding without approval of OPM.

P-86—Material for production and packaging industrial explosives (12-12). Related form: PD-82.

P-87—Scarce material for insecticide, germicide and fungicide production (12-13). Related form: PD-82.

Under "L Orders," page 4, add:

L-1-a—Supplement No. 1 (12-10). Adjusts January production quotas of certain passenger carrier producers.

L-2-b—Amendment No. 1 (12-10). Postpones effective date of bright work ban to Dec. 31 for existing stocks and lists certain exemptions.

L-6-a — February ironer and washing machine quotas (12-12).

L-23—Curtails production of stoves, ranges, other domestic cooking appliances (12-13). Related forms: PD:192 and PD:203.

Under "M Orders," page 5, add:

M-15-b—Restricts use of rubber and materials in which rubber is a compound, including prohibition of tire sales between Dec. 11 and 22 (12-11).

M-49—Iridium use in jewelry (12-12).

Under "OPA Price Schedules," page 5, add:

No. 47—Old rags (12-6).

Under "Ratings Given Defense Items," page 9, add:

Farm machinery and equipment, P-32, is listed as assigning a rating of A-1-b. This is incorrect. It should be A-10.

New Priority Plan to Simplify Use of PD-25-a

Washington

• • • OPM is expected shortly to announce a variation of the Production Requirements Plan. It will be called the Standard P order and designed primarily to meet the needs of a manufacturer or a single plant or division of a manufacturing company, engaged exclusively or predominantly, in making a single product or class of product almost all of which are intended for direct defense or for one or two categories of essential civilian uses.

There are two points of differ-

ence between PRP and the new plan: (a) Under the standard plan only a single rating will be granted and this rating is stated in the order, whereas in the case of PRP the rating is stated only on the copy of PD-25-a returned to the applicant, and (b) the form upon which the applicant states his needs, his past experience, etc. is simpler than Form PD-25-a.

The application form to accompany the Standard P order is still in the process of revision. It is similar to PD-25-a, but will omit certain of the data required. Pending preparation of such form, the PD-25-a will be used, accompanied by directions to omit certain portions. The new order will be administered through the industry branch or section responsible for the product or products covered by the order.

Reports Must Be Filed OPM Warns Industry

Washington

• • • A few isolated refusals to report on inventories, needs and uses of certain critical materials caused OPM's Priorities Division to issue a warning last week that war conditions make it more important than ever that American business and industry comply immediately and wholeheartedly with all orders and requests for information issued by the Division.

OPM said that one firm, which had delayed making a requested report, wired Director Donald M. Nelson declining to do so, stating that a national emergency was no time to be asking for or filing reports.

In his reply, ordering that the report be made immediately, Mr. Nelson said, "Your refusal is unwarranted and has impeded the proper administration of the priorities system."

Stove Output Curtailed

• • • An initial saving of about 58,000 tons of steel in the first quarter of 1942 is estimated by OPM's Priorities Division as the result of its order of Saturday curtailing the production, beginning Jan. 1, of a wide variety of stoves, ranges, and other domestic cooking appliances. The order calls for an average cut of 35 per cent in iron and steel use during the period from Jan. 1 to April 30 from the amount used in the year ended June 30, 1941. Until the curtailment becomes effective, the use of the required critical materials will be frozen at the level of the average daily use during the 12-month base period. It was stated that producers affected by the order, numbering about 20, used approximately 500,000 tons of iron and steel in the year ended June 30, 1941.

Tin Plate Ratings Likely

Pittsburgh

• • • The scrap shortage in the steel industry is expected to force a decision on the granting of priority ratings to tin plate requirements. Reports reaching here indicate that the government will allocate scrap on the basis of the total percentage of "rated" business for war purposes on which

any company is engaged. Tin plate, although slated as an essential requirement for war, has never been officially assigned a definite priority rating in the A series.

Several months ago Leon Henderson specified that tin plate was an important product for defense and would be considered as such to the exclusion of other less essential steel requirements.

While every steel company making tin plate obviously assumes that tin plate production is all important for defense and carrying on the war, they may be stymied in obtaining scrap in sufficient quantities to maintain full defense production unless their tin plate output is granted some official recognition as being a war time requirement.

According to reports here, the placing of tin plate production on an allocation or priority basis is being actively considered and recommended at the present time. A move was on foot some months ago to place tin plate on an A-2 rating but nothing came of this, with the result that the declaration of war found one of the most vital defense needs without an official class A priority rating.

Bar Allocations Jan. 1

Pittsburgh

• • • **Mandatory allocation** of hot rolled bars going to cold drawers becomes effective Jan. 1, 1942, according to reports reaching THE IRON AGE here. This will be the second item on the all-out allocation list, the first having been plates.

It is said that the performance of each company in its shipments to cold drawers during 1940 will be used as the basis for OPM allocations in 1942.

For example, it is said a company whose shipments of hot rolled bars to converters amounted to 30 per cent of its total hot rolled bar shipments, would be allocated 30 per cent of the total tonnage of hot rolled bars which the OPM decides are to go to cold drawers in the first quarter of 1942. Likewise, the individual hot rolled bar maker will use his 1940 shipping performance in determining how to distribute the amount of hot rolled bars allocated to him by the OPM in the first quarter of 1942 for delivery to cold drawers.

It is said practically the entire output of cold drawn carbon and alloy bars is for rated tonnages, with a large portion going for Army and Navy requirements. The latter it is said, are on the increase and will be substantially higher as 1942 progresses.

Warning on PD-73

Steel plate consumers must continue to file form PD-73, despite the fact that plates are now under full allocation, OPM advises. In addition to the fact that PD-73 is required by law, the information contained in the forms is necessary in working out allocations, officials explained.

Ferroalloy Prices Hold For First Quarter of '42

• • • **Prices for** ferromanganese, ferrosilicon and silico-manganese will continue unchanged through the first quarter of 1942. In making this announcement OPA said that all of the major producers of ferromanganese indicated that they did not intend to advance current prices for the first quarter while producers of ferrosilicon and silico-manganese have entered into individual agreements with OPA to continue to sell at present levels.

The general market level of $120 a ton, Atlantic seaboard, for ferromanganese, has remained unchanged since July 1, 1940, it was stated, excepting in the case of one relatively small high cost producer, located in the South. This producer has been charging $25 a ton above the general level and has been asked by OPA to reduce the price to $135, f.o.b. furnace.

It was stated that the price involved in the individual agreements with ferrosilicon producers is $74.50 a gross ton in carlots, with freight allowance to St. Louis, for the 50 per cent grade, which represented the largest tonnage production.

Electrodes Not Covered

• • • **OPM has** announced that it erroneously stated in a release of Nov. 29 that electrodes were included in the priority assistance granted by extension of Preference Rating Order No. P-39, covering arc welding and resistance welding equipment.

Iridium Use Limited

• • • **In prohibiting** the use of iridium and its alloys in the manufacture of jewelry, except upon specific permission, OPM's Priorities Division said that the purpose of its order is to conserve iridium for military use, principally for the manufacture of hardened platinum magneto points for aircraft. Iridio-platinum alloy also is used in control instruments for tanks and other motorized war equipment.

Retail Priorities

• • • **The OPM Priorities** Division has pointed out that retail consumers cannot and must not be expected to produce preference rating certificates when placing normal orders for finished goods. The announcement was due to what was said to be confusion on the part of many distributors of consumers' goods who have told their customers that they cannot sell to them unless their orders are accompanied by preference rating certificates.

If you want quicker action on your correspondence with OPA or OPM, defense authorities advise putting on the address on the envelope either the commodity branch, the price schedule number or the priority order number involved in your question. Thus, a letter concerning repairs should be marked "Reference: P-22", or a question on nickel scrap prices should be addressed either to the commodity branch handling that product or the envelope should be marked "Reference: Price Schedule No. 8, Nickel Scrap."

In the case of important civilian items, as for example, farm machinery and spare parts for privately owned automobiles and trucks,

the Priorities Division has given assistance to manufacturers so that they may continue their production. The goods manufactured as a result of this assistance are then made available through the normal trade channels, and retail buyers in general do not need, and have not been issued, preference rating certificates, OPM said.

Explosive Makers Aided

• • • **OPM last week** issued an order granting an A-8 rating to manufacturers of industrial explosives, to assist them in acquiring the materials necessary for the production and packaging of their products. The Priorities Division issued Preference Rating Order P-86, which it said will be made available to known efficient producers, following their application for specific quantities of materials. Producers must apply for the assistance of the order on Form PD-82, addressed in triplicate to OPM's Chemical Branch.

Order P-46 Amended

• • • **Utilities,** electric, gas, water, public sanitation services and central steam heating, must obtain permission from OPM, according to amendments to Preference Rating Order P-46, before extensive expansion is undertaken. No materials for expansion of underground connections may cost more than $1,500, or more than $500 for other uses without OPM's permission.

This is in keeping with SPAB's announced policy of disapproving projects for new or expanded utilities unless considered essential. Projects 40 per cent complete Dec. 5 may be finished if supplies are on hand.

Juke Box Output Cut

• • • **Based** on the average output for the year ended June 30, 1941, production of juke boxes, scales, and slot machines played for amusement was ordered reduced 25 per cent in December, 50 per cent in January and 75 per cent beginning Feb. 1 to continue until further notice. During December, production of gaming machines will be cut 50 per cent. This cut will be 75 per cent in January and 100 per cent in February.

Seizure of Metal Stocks Seen As U.S. War Effort Grows

• • • **Stricter control** over all inventories of strategic materials, accompanied by formal requisitioning of such material when it is not being put to direct war use, probably will develop over the next few weeks as industry girds for an all-out war effort.

Buried among last week's war communiques (see THE IRON AGE, Dec. 11, p. 101H) was an announcement that defense agencies were mapping a proceedure for seizing stock piles when necessary. The real significance of this announcement was lost in the general confusion surrounding the outbreak of war with Japan, but to many in-

dustrial plants this development may be of the utmost importance, particularly to civilian plants living off inventories built up earlier this year.

OPM has long had power to control stocks through Priorities Regulation No. 1, but has been slow to use this authority. Now, however, with the armament effort passing from the "defense" stage to the "war" stage, and with the Far Eastern fighting threatening supplies of such critical material as rubber, tin, manganese, tungsten, etc., defense officials may be forced to use this power to fill gaps in dedense plant needs.

The attitude of OPM has often been expressed. Briefly, it favors stocks limited only to the minimum requirements needed to assure continuity of production. Probably the question of inventories represented by products "in process" will be the most difficult to overcome.

First to be hit will be civilian plants, many of whom have for the past month been existing on a meagre doling out of stocks acquired before priorities went into effect. In the past requisitioning has been largely limited to material ordered by foreign countries but unshipped due to war conditions. The Navy, in this manner, has taken over substantial amounts of zinc ordered by Belgium, and aluminum purchased by the French has been similarly treated. More recently, steps have been taken to divert steel held for foreign account into domestic trade.

Heralding this new drive on excessive inventories was the announcement last week of the establishment of a new Inventory and Requisitioning Section of OPM, headed by E. A. Tupper. Officially, the activities of this section "will not be used to interfere with control over the flow of materials to war and essential civilian industries by the priorities system, but will supplement the priority system whenever priority orders are insufficient to get essential materials to the right place at the right time." A survey of existing inventories of scarce materials is already under way.

Apparently the requisitioning activities of all government agencies, such as the Army, the Maritime Commission, Department of Agriculture, etc., will be funneled through the OPM.

Compensation for the materials so seized will be a "fair compensation" and procedure has been established for appeals from any price set by OPM for such material.

Many plants are already preparing themselves for such action. In view of past experience with OPM and OPA, observers comment that it would be advisable for all plants to prepare in advance an accurate report of what constitutes a minimum inventory and back up this report by as much detail as possible. Having such a report prepared may well save valuable time in establishing what is a minimum inventory and may avoid unreasonable requisitioning.

In addition to rapid moves to control prices of materials imported from the Far East, OPA last week established a new phase of price control, a step made necessary, it was said, by the Japanese war. That step was the request directed toward producers of alcohol, acetone and butanol requesting that they refrain from quoting prices for delivery beyond Jan. 1.

On the Assembly Line

(CONCLUDED FROM PAGE 78)

through its field offices. One of the items of great interest is a list of government specifications for aircraft parts. These are specifications issued by the Army, the Navy, and Air Corps separately on different occasions, and sometimes jointly by the Army and Navy. The listing brings together all of the specifications on carbon and alloy steels and all the specifications on stainless steel for aircraft. The data include various government specification numbers, dates, chemical composition, physical properties, information on the condition of the materials usually furnished and the commodity usually furnished by steel companies.

This report also lists and coordinates various designations that have been issued by the Society of Automotive Engineers, the American Iron and Steel Institute and the joint group of engineers who have prepared what are called Aeronautical Materials Specifications.

OF general interest is an alphabetical list of aircraft parts, including structures, power plants, accessories and landing gear. The booklet reveals that many common parts of aircraft are being made of a great variety of alloys, possibly because various manufacturers just haven't got together and seen eye-to-eye on specifications. For example, crankshafts are being made of 11 different SAE steels, seven different AMS steels and five different AISI steels. A section of the book deals with nomenclature, the question of how a plane flies and photographs of typical airplanes and their parts.

Automotive engineers look aghast at OPA's suggestion that engines be redesigned at lower compression ratios to accommodate them to lower grade fuels. Since any change in design or in compression ratio would require retooling, it is worth while to take a second look at this suggestion.

Probably it was advanced by someone not the least technically minded—since that is the only apology that can be offered. The idea probably had its roots in the fact that there is talk now about reducing the amount of tetraethyl lead (the Ethyl anti-knock fluid) in gasoline for civilian use. This fuel now requires one or two cubic centimeters of Ethyl fluid per gallon. Reason for reducing the amount is some fear about the lead situation, combined with the fact that the process of making tetraethyl lead requires the use of chlorine.

Aside from the fact that changing the compression ratio on new cars now being built would not benefit the 31½ million cars already on the road, the OPA seems to have overlooked something else.

It is a known fact (to anyone who has lifted a hood of an automobile engine) that the engines are already adjustable to quite a range of fuels. Merely by changing the timing—and that can be accomplished by adjusting a gadget under

the hood—the modern automobile engine can successfully use either low octane number fuels or high octane number fuels. Probably a useable range is someplace between 65 octane number (the lowest mentioned so far as being a probability) and up to 87 or 90. Actually the engine might operate either above or below this range, but economy and performance would be doubtful factors. As regards the low octane number fuels, many vehicles in out-of-the-way spots such as Mexico and South and Central America probably get along now on fuels pretty close to the 65 octane rating.

Lower compression ratios would cause a substantial loss in power output from engine, and would be accompanied by uneconomical performance. More than that, when better fuels again became available, the cars would still be short of power and economy.

Concluding what is probably its final week of near-normal output, the auto industry produced 95,990 cars and trucks in the period ended Dec. 12, compared with 92,205 in the previous week (revised) and 131,175 units in the corresponding week of last year, according to Ward's Reports, Inc.

Bombsights Delayed by Strike Six Weeks Old

Chicago

• • • **After five days** of war against Japan, work on bombsights and 155 mm. guns was still being held up by strike at the Lammert & Mann Co. here. The work stoppage was six weeks old at the end of last week. The machinists' union of the A. F. of L. is the labor organization involved.

Both sides told THE IRON AGE conflicting stories. R. F. Lammert, president of the firm, stated that the union had entered and then withdrawn a petition for an election to determine bargaining rights. According to Lammert, "the union now refuses to permit an election and yet it is holding up this war work on the issue of recognition."

A union spokesman claimed the shop was 100 per cent unionized but that the company refused to bargain. According to the machinists' group, all of the company's employees are now at work on defense contracts in other plants. The company holds about $500,000 worth of orders for clutch parts, gear blanks, etc., for 155 mm. guns and for turret races and other parts for bombsights. Between five and six tons of aluminum to be used in the bombsights has been removed from the company by the Army and sent to other plants holding similar contracts. About 15 tons of steel have also been removed.

Has $22.5 Million in Orders

• • • **Jack & Heintz Co.**, which has received large orders for automatic pilots for airplanes, reports its present backlog of defense orders approximates $22,500,000.

Government Awards . . .

War Dept., Ordnance:

Robert Abel, Inc., Boston; material for overhead crane and hoist system $8,519
Acme Bronze Powder Co., New York; flaked aluminum 2,680
Addressograph - Multigraph Corp., Cleveland; ammunition 196,470
shells 80,862
Affiliated Machine & Tool Co., Inc., New York; gun parts 1,022
Ahlberg Bearing Co., Chicago; tapers, rollers, cups, bearings, etc. 4,542
Ainge Tool & Engineering Co., Springfield, Ohio; gages 1,490
Allegheny-Ludlum Steel Co., Brackenridge, Pa.; gages 23,100
steel 2,055
Alliance Machine Co., Alliance, Ohio; pinion shafts 1,225
Alton Iron Works, Inc., New York; steel bar 2,428
American Brake Shoe & Foundry Co., Brake Shoe & Castings Division, New York; castings 3,238
American Brass Co., Waterbury, Conn.; phosphor bronze tubing .. 3,623
bronze 4,538
American Car & Foundry Co., New York; miscellaneous tank parts. 25,806
American Foundry Equipment Co., Mishawaka, Ind.; shot for wheelabrator 2,112
American Hardware Corp., New Britain, Conn.; ammunition 140,000
American Locomotive Co., Schenectady; forgings 23,500
American Steel & Wire Co., Cyclone Fence Division, Springfield, Mass.; chain link fence 1,467
Apex Electrical Mfg. Co., Cleveland; machine gun mounts 3,000,640
Apex Tool & Cutter Co., Inc., Shelton, Conn.; cutters and blades .. 1,658
Autocar Co., Ardmore, Pa.; ratchet wrenches 16,154
Automatic Die & Products Co., Cleveland; punches and dies 1,089
Bakewell Mfg. Co., Los Angeles; tapping machines 3,888
Baldwin Locomotive Works, Philadelphia; tubes 2,960
Baldwin Locomotive Works, Baldwin Southwark Division, Philadelphia; pumps 13,475
Barbour Stockwell Co., Cambridge, Mass.; drills 10,000
Barker Tool Die & Gauge Co., Detroit; gages 9,205
Barwood Co., Philadelphia; gages.. 6,614
John Bath & Co., Inc., Worcester; gages 5,087
Bay State Abrasive Products Co., Camden, N. J.; grinding wheels. 1,111
Bay State Tool & Machine Co., Springfield, Mass.; gun parts ... 4,926
Belmont Smelting & Refining Works,, Inc., Brooklyn; copper ingots 2,624
Bendix Aviation Corp., Eclipse Machine Division, Elmira, N. Y.; ammunition 220,000
Bendix Aviation Corp., Eclipse Aviation Division, Bendix, N. J.; electric starters and hand crank housings 1,055
parts for tanks 45,190
Bethlehem Steel Co., Bethlehem, Pa.; steel bar 2,500
steel 13,012
Billings & Spencer Co., Hartford; shoes for use on hammers 1,080
Binks Mfg. Co., Chicago; paint spray booths 5,057
Boyt Harness Co., Des Moines, Iowa; gun slings 376,968
Braeburn Alloy Steel Corp., Braeburn, Pa.; steel 9,761
Bridesburg Engineering Co., Philadelphia; wrenches and spanners 1,212
Briggs & Stratton Corp., Milwaukee; fuzes 46,620
Brown & Sharpe Mfg. Co., Philadelphia; cutters 3,329
milling machines 49,533
tools 5,844
grinders 2,867
Budd Wheel Co., Detroit; ammunition 693,000
spare parts 14,567
shells 250,000
Buffalo Forge Co., Buffalo; shears 7,998
Buffalo Foundry & Machine Co., Buffalo; crystallizing kettles and drives 137,229
Canister Co., Phillipsburg, N. J.; assembling and crimping machines 53,300
Carpenter Steel Co., Reading, Pa.; steel 1,141
Central Iron & Steel Co., Harrisburg, Pa.; steel floor plates ... 1,012
Champion Co., Springfield, Ohio; ammunition 177,350
Chase Brass & Copper Co., Waterbury, Conn.; time train rings for fuze 354,000
rods, brass 15,481
Chattanooga Stamping & Enameling Co., Chattanooga, Tenn.; mines 64,800

Chicago Electric Mfg. Co., Chicago; percussion primers 56,400
Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati, Ohio; machines 41,230
milling machines 22,971
grinders 16,944
Victor V. Clad Co., Philadelphia; furnish and install cafeteria and kitchen material 19,495
Cleveland Hardware & Forging Co., Cleveland; forgings and dies 66,016
Cleveland Twist Drill Co., Cleveland; reamers 1,749
Coleman Lamp & Stove Co., Wichita, Kans.; ammunition chests.. 411,804
Coleman Range & Stove Co., Wichita, Kan.; shells 80,446
Colt's Patent Fire Arms Mfg. Co., Small Arms Division, Hartford; gun components 44,010
Columbus Auto Parts Co., Columbus, Ohio; forgings 1,317,500
Continental Can Co., New York; packing cans 2,952
Continental Machines, Inc., Minneapolis; machines, sawing and band filing 1,867
Continental Tool Works, Detroit; tools 3,890
Crucible Steel Co. of America, Pittsburgh; steel bar 2,449
Dahlquist Mfg. Co., Inc., Somerville, Mass.; deflectors 1,475
Davenport Machine Tool Co., Inc., Rochester, N. Y.; holders, sizing tool 1,414
drill spindles 1,583
Dean Machinery Co., Inc., Chicago; lathes 56,429
Defiance Automatic Screw, Defiance, Ohio; shells 73,000
Detroit Broach Co., Inc., Detroit; broach sections 1,302
Diamond Chain & Mfg. Co., Philadelphia; chains 2,625
Henry Disston & Sons, Inc., Philadelphia; armor plate 33,135
Dravo Corp., Cleveland; boiler for power plant 89,814
Duff-Norton Mfg. Co., Pittsburgh; forgings 509,145
jacks 26,400
Dumore Co., Racine, Wis.; lathe grinders 1,178
Durham Mfg. Co., Muncie, Ind.; mines 61,800
Easy Washing Machine Corp., Syracuse, N. Y.; percussion primers 84,864
Electric Arc, Inc., Newark, N. J.; parts for generating units 1,518
Electric Auto-Lite Co., Toledo; steel cartridge cases 89,400
Electric Motor Repair Co., Springfield, Mass.; electric motors ... 1,157
unitrols 13,512
Elliott-Lewis Electrical Co., Inc., Philadelphia; wire 1,004
Emerson Electric Mfg. Co., St. Louis; boosters 117,810
O. L. Engstrom, New York; punches and dies 4,413
Everedy Co., Inc., Frederick, Md.; practice mines 78,150
Ex-Cell-O Corp., Detroit; grinding spindles 1,433
A. B. Farquhar Co., Ltd., York, Pa.; mortars and mounts 5,855
Federal Products Corp., Philadelphia; gages 4,680
Federal Tool Corp., Chicago; gages 1,185
Flannery Bolt Co., Bridgeville, Pa.; closing plugs 44,080
Fox Munitions Corp., Philadelphia; gages 1,647
Fram Corp., E. Providence; cartridges, replacement for oil cleaner 8,370
S. Froehlich Co., Inc., New York; gun slings 218,500
B. R. Gale Co., Boston; material for exhaust systems. 3,260
Garlock Packing Co., Chicago; oil retainers 1,034
General Electric Supply Corp., Springfield, Mass.; cable 1,013
General Motors Corp., Detroit; ammunition 6,780,000
bolts 291,630
General Motors Corp., Cadillac Motor Car Division, Detroit; tanks . 65,000
General Motors Corp., Delco Brake Division, Dayton, Ohio; fuzes... 286,200
General Tool & Mfg. Co., Irvington, N. J.; dies 33,750
Geometric Tool Co., New Haven, Conn.; taps and chasers 1,190
Wm. Gessell Mfg. Co., New York; fuzes 73,242
Fred I. Getty, Jennings, La.; finishing gun tubes 240,000
G. M. Gibson Co., Bellevue, Iowa; oil cans, oil gun caps, etc. 40,914
Glascock Mfg. Co., Muncie, Ind.; mines 66,000
Globe Forge & Foundries, Inc., Syracuse, N. Y.; forgings 2,809
Goddard & Goddard Co., Inc., Detroit; hobs 3,688
Graybar Electric Co., Inc., Philadelphia; wire 1,154

Greenfield Tap & Die Corp., Greenfield, Mass.; gages 15,604
Grenby Mfg. Co., Plainville, Conn.; grinders 1,078
Gries Reproducer Corp., New York; gages 2,266
Haines Gauge Co., Inc., Philadelphia; gages 1,672
Hamlin Metal Products Co., Akron, Ohio; practice mines 85,500
Hampden Brass Co., Springfield, Mass.; castings 3,343
Hanson Whitney Machine Co., Hartford; thread milling hobs.. 1,200
milling cutters 1,020
taps 1,995
Louis Hanssen's Sons, Davenport, Iowa; parts for gun carriages.. 10,714
Harding Machine Screw Co., East Liberty, Ohio; percussion primers 86,000
Hatfield Wire & Cable Co., Hillside, N. J.; wire 3,175
W. F. Hebard & Co., Chicago; tractors 3,920
cranes 7,935
Heekin Can Co., Cincinnati; containers 31,779
Herper-Wyman Co., Chicago; percussion primers 34,096
Hess & Barker Co., Philadelphia; lathe repairs 1,660
High Standard Mfg. Co., New Haven, Conn.; guns 10,254,557
R. Hoe & Co., Inc., New York; gun recoil mechanisms 1,900,876
Horst & Strieter Co., Rock Island, Ill.; housings and cables; oil pan packings; rear brake shafts; springs, etc. 1,363
Howard Clock Products, Inc., Waltham, Mass.; pinions 3,750
International Harvester Co., Springfield, Mass.; truck tractors and semi-trailers 5,696
F. L. Jacobs Co., Detroit; plugs, pins, springs, etc. 2,389
Johnson-Claflin Corp., Marlboro, Mass.; gages 3,673
Johnson & Dealaman, Inc., Newark; trailers 4,962
Johnson Metal Products Co., Erie, Pa.; ammunition chests 452,960
Jones & Lamson Machine Co., Springfield, Vt.; comparators .. 1,100
Karp Metal Products Co., Inc., Brooklyn; repair kits 1,423
Kearney & Trecker Corp., Milwaukee, Wis.; milling machines ... 197,884
John P. Kelly, Philadelphia; castings 3,430
Kent Machine Co., Cuyahoga Falls, Ohio; screw slotting machines. 1,080
Kent-Moore Organization, Inc., Detroit; tools 1,526
Kilby Steel Co., Anniston, Ala.; shell machining 83,993
Kilgore Mfg. Co., International Flare-Signal Division, Tipp City, Ohio; signal cartridges 3,379
Landis Machine Co., Waynesboro, Pa.; equipment for machines ... 1,237
Larkin Packer Co., Davis Boring Tool Division, St. Louis; boring bars 1,117
La Salle Steel Co., Chicago; steel.. 2,348
LaSalle Tool & Gauge, Inc., Detroit; gages 2,421
Latrobe Electric Steel Co., New York; steel 1,158
Leatherwear Co., Inc., Middletown, N. Y.; gun slings 162,500
LeTourneau Co. of Ga., Toccoa, Ga.; shells 6,000
Letts Drop Forge, Inc., Detroit; forgings 1,400
Lincoln Park Tool & Gage Co., Lincoln Park, Mich.; gages 15,072
dies 1,863
Sven Frithiof Lindbloom, Providence; gages 1,136
Linderme Tube Co., Euclid, Ohio; burster tubes 195,323
Lindsley Mfg. Co., Milford, Conn.; tools and fixtures 276,011
Line Material Co., Milwaukee; shells 280,548
Lundquist Tool & Mfg. Co., Worcester; cable and plug assemblies 6,808
Machined Metals Co., Philadelphia; rear band assemblies 93,975
Madison-Kipp Corp., Madison, Wis.; fin assemblies 79,527
Magnus Tool & Die Co., Newark; tools and fixtures 221,098
R. C. Mahon & Co., Detroit; steel doors 1,120
Majestic Tool & Mfg. Co., Detroit; fixtures 1,050
McCord Radiator Co., Detroit; parts for helmets 100,550
Mercury Mfg. Co., Chicago; trucks 3,975
Merz Engineering Co., Indianapolis; gages 11,588
Metal Goods Corp., St. Louis; seamless brass tubing and brass rods 5,913
Metal Specialty Co., Cincinnati; mines 62,700

Midvale Co., Philadelphia; ammunition 202,000
Midwestern Tool Co., Chicago; gages 9,214
Miller Supply Co., Chicago; pipes 1,882
H. W. Mills & Co., Paterson, N. J.; drills 2,562
Mills Novelty Co., Chicago; shells 267,776
Milwaukee Saddlery Co., Milwaukee; gun slings 346,000
Minnich Machine Works, Inc., Philadelphia; presses 1,548
Modern Tool & Die Co., Philadelphia; gages 26,859
Mueller Brass Co., Port Huron, Mich.; percussion primers 61,320
Murray Co., Carver Cotton Gin Co. Division, East Bridgewater, Mass.; dummy projectiles 22,740
National Brass Co., Grand Rapids, Mich.; percussion primers 61,101
National Pneumatic Co., Rahway, N. J.; ammunition 4,977,264
National Tool Salvage Co., Detroit; altering and reconditioning cutting tools 1,157
Herman Nelson Corp., Moline, Ill.; mud guards, head lamps, etc. .. 43,367
New York Thread Grinding Corp., New York; gages 1,010
Niles-Bement-Pond Co., Pratt & Whitney Division, West Hartford; barrel drilling machines.. 15,826
comparators, gages, etc. 3,767
reaming machines 14,372
gage blocks 3,315
tools 1,108
Noblitt-Sparks Industries, Inc., Columbus, Ind.; mines 56,911
Norco Metal Products Co., Philadelphia; punches 8,650
Northern Sales Co., Philadelphia; machine screws 2,985
Norton Co., Worcester; grinding wheel points 1,194
grinders 75,156
Ohio Seamless Tube Co., Shelby, Ohio; seamless steel tubing 1,047
Arthur J. O'Leary & Son Co., Chicago; forgings 2,679
Onsrud Machine Works, Inc., Chicago; routers 3,478
Ordnance Gage Co., Philadelphia; services to modify gages 1,326
Otis Elevator Co., New York; gun mechanisms 1,930,400
castings 4,157
Parent Metal Products, Inc., Philadelphia; shelving and ladders ... 1,996
tables 3,514
Park City Tool & Die Co., Bridgeport, Conn.; fixtures 1,500
Patterson Foundry & Machine Co., East Liverpool, Ohio; agitating equipment 4,794
Pennsylvania Tool & Mfg. Co., York, Pa.; gages 5,819
Perry-Fay Mfg. Co., Elyria, Ohio; shells 95,630
percussion primers 54,000
Philadelphia Bronze & Brass Corp., Philadelphia; castings 31,408
Pipe Machinery Co., Cleveland; gages 3,540
Pittsburgh Motor Heater Corp., Pittsburgh; ammunition 232,475
H. W. Porter & Co., Inc., Newark; pipe insulation 2,196
Precise Tool & Mfg. Co., Farmington, Mich.; gages 6,620
Precision Mfg. Co., Dover, N. J.; gages 14,749
Henry Prentiss & Co., Boston; milling machines 11,011
hobbing machines 93,871
profilers 30,408
grinders 14,662
Producto Machine Co., Bridgeport, Conn.; routing machines 15,650
countersinks 1,800
Quality Tool & Die Co., Indianapolis; gages 2,412
W. B. Rapp, Philadelphia; presses 1,960
A. B. & J. Rathbone, Palmer, Mass.; drawing steel 1,500
Rau Fastener Co., New York; plates, sockets, studs, etc. 3,754
Reliable Spring & Wire Forms Co., Cleveland; springs 2,566
Reliable Tool Co., Inc., Irvington, N. J.; guides and tools 1,075
Reliance Steel Casting Co., Pittsburgh; castings 10,900
Remington Arms Co., Inc., Bridgeport, Conn.; gun barrels 150,835
Remington Rand, Inc., Washington; cabinets and trays 1,349
Republic Electric Co., Davenport, Iowa; cable 4,891
Republic Steel Corp., Hartford; steel 3,959
Reynolds Metals Co., Louisville, Ky.; aluminum alloy 1,143
Robertshaw Thermostat Co., Youngwood, Pa.; percussion primers.. 57,071
boosters 56,360
Roller Bearing Co. of Washington; roller bearings 1,385
Frank Rose Mfg. Co., Dutton Lainson Co. Mfg. Division, Hastings, Neb.; accessories and electrical parts 2,935

Saco-Lowell Shops, Biddleford, Maine; drilling gun barrels ... 15,000
Safe Guard Corp., Lansdale, Pa.; punches ... 2,610
St. Louis Steel Products Co., St. Louis; arming wire assemblies. 60,350
Schlosser Mfg. Co., Inc., Philadelphia; gages ... 1,192
Schlueter Mfg. Co., St. Louis; mines ... 65,250
Schneider, Bowman Co., Inc., Philadelphia; cast iron ... 1,391
W. J. Schoenberger Co., Cleveland; percussion primers ... 61,320
Schuylkill Forge Co., Philadelphia; forgings ... 2,697
Scully-Jones & Co., Chicago; sleeves and sockets ... 1,360
Sheffield Corp., Dayton, Ohio; gages 6,229
W. E. Shipley Machinery Co., Philadelphia; overhaul and repair automatic screw machine .. 2,400
oil extractors ... 3,319
Shuler Axle Co., Louisville, Ky.; forgings ... 7,235
Sipp-Eastwood Corp., Paterson, N. J.; tools and fixtures ... 308,500
Sivyer Steel Casting Co., Milwaukee; castings ... 1,512
H. A. Smith Machinery Co., Syracuse; rigidmils and equipment.. 33,385
lathes ... 46,890
L. C. Smith & Corona Typewriters, Inc., Syracuse, N. Y.; percussion primers ... 173,912
Standard Container, Inc., Bloomfield, N. J.; containers ... 39,895
Standard Gage Co., Inc., Poughkeepsie, N. Y.; gages ... 9,941
Stedfast & Roulston, Inc., Boston; machines, indexing station 30,786
Sterling Alloys Co., Woburn, Mass.; castings ... 8,494
Stewart Warner Corp., Chicago; heaters ... 98,245
F. J. Stokes Machine Co., Philadelphia; conversion of machines .. 7,500
Suburban-Essex Machinists, Inc., Orange, N. J.; gages ... 24,298
Summerill Tubing Co., Bridgeport, Pa.; seamless steel tubing ... 32,960
Superior Sheet Steel Co., Canton, Ohio; terne plates ... 94,672
Superior Steel Products Co., Inc., Muncie, Ind.; ammunition ... 231,000
Swind Machinery Co., Philadelphia; equipment for lathes ... 1,746
Taft-Peirce Mfg. Co., Woonsocket, R. I.; gages ... 1,843
Texas Washer Co., Houston, Tex.; fin assemblies for shells ... 81,225
Timken-Detroit Axle Co., Detroit; gun parts ... 1,469
Timken-Detroit Axle Co., Wisconsin Axle Co. Division, Oshkosh, Wis.; drives and cases ... 22,144
Timken Roller Bearing Co., Canton, Ohio; roller bearings ... 7,565
Timken Roller Bearing Co., Steel & Tube Division, Canton, Ohio; seamless steel tubing ... 2,566
Titan Metal Mfg. Co., Bellefonte, Pa.; time train rings for fuze.. 273,441
Tools & Gages, Inc., Cleveland; gages ... 22,838
Towmotor Co., Cleveland; trucks. 2,327
Tri-Clover Machine Co., Kenosha, Wis.; shells ... 86,195
Triplex Machine Tool Corp., New York; hydraulic presses ... 3,850
Truscon Steel Co., Buffalo; reinforcement rods ... 10,660
Union Hardware Co., Torrington, Conn.; reamer shanks ... 1,355
Union Twist Drill Co., Athol, Mass.; end mills, cutters and reamers ... 3,535
grinders ... 2,362
Unique Specialties, Inc., New York; sleeves, housings and punches ... 2,355
United Drill & Tool Corp., Whitman & Barnes Division, Detroit; drills ... 2,319
U. S. Motors Corp., Oshkosh, Wis.; parts for generating units ... 2,910
United Wire & Supply Corp., Cranston, R. I.; brass tubing .. 2,250
Universal - Cyclops Steel Corp., Titusville, Pa.; steel ... 2,322
Universal Drafting Machine Co., Cleveland; drafting machines .. 2,004
Universal Lubricating Systems, Inc., Oakmont, Pa.; shells ... 80,263
Valley Steel Castings Co., Bay City, Mich.; castings ... 8,973
Veit & Young, Philadelphia; dies, punches, etc. ... 63,250
Van Dyck Churchill Co., New York; drills ... 23,983
Vinco Corp., Detroit; gages ... 3,510
plugs ... 1,145
Wadell Engineering Co., Newark; tools, drawbars, belts, etc. ... 94,635
Wagner Electric Corp., St. Louis; shells ... 86,095
Ward La France Truck Corp., Elmira, N. Y.; trucks ... 827,049
Warren Telechron Co., Ashland, Mass.; percussion primers ... 51,830
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.; machines ... 69,455
Watson-Stillman Co., Roselle, N. J.; presses and fixtures ... 293,737

Westinghouse Electric & Mfg. Co., Boston; controllers	20,049
Westinghouse Electric Supply Co., Davenport, Iowa; cable	6,623
Wheeling Stamping Co., Wheeling, W. Va.; percussion primers	52,531
Whitehead Metal Products Co., Inc., Newark; bronze	2,010
Wiedemann Machine Co., Philadelphia; gages	3,650
J. H. Williams & Co., Buffalo; forgings and dies	6,410
Wright Machine Co., Worcester; boosters	187,200
Yale & Towne Mfg. Co., Philadelphia; trucks, lifting	11,247
Yellow Truck & Coach Mfg. Co., Pontiac, Mich.; cars	85,000
Zimmerman Steel Co., Bettendorf, Iowa; steel castings	1,205
Zipit Corp., Philadelphia; gages	2,970

War Dept., Corps of Engineers:

Aircraft Tools, Inc., Los Angeles; drill heads and drills	$2,887
American Bridge Co., Pittsburgh; steel pontoons	18,000
American Hoist & Derrick Co., New York; hoists and parts	16,823
American Petrometal Corp., Long Island City; steel bars	3,287
Dorsey C. Anderson, Philadelphia; welders, electric arc	61,440
Baker-Raulang Co., Cleveland; electric trucks	6,450
Baldwin Locomotive Works, Baldwin Southwark Division, Philadelphia; test machines	18,810
Barnes Drill Co., Rockford, Ill.; drill presses	6,070
Bethlehem Steel Export Corp., New York; turnouts, one meter gage	71,496
steel, tool	23,486
H. O. Bigham, Spokane, Wash.; rental of flatbed trucks	372
E. J. Booksby & Co., Philadelphia; boring bars, crank pin turning machines and parts	7,376
Buckeye Steel Castings Co., Columbus; steel castings	233,970
Buffalo Bolt Co., North Tonawanda, N. Y.; drift bolts	4,553
Buffalo-Springfield Roller Co., New York; steam roller cabs and electric starters	5,460
Capitol Steel Corp. of N. Y., New York; steel reinforcing bars	11,164
Carnegie-Illinois Steel Corp., Pittsburgh; steel sheet piling	206,964
Caterpillar Tractor Co., Peoria, Ill.; tractors	55,112
Century Equipment Corp., New York; engine and generator sets and parts	26,969
Century Sprinkler Corp., Richmond, Va.; sprinkler systems, Charlotte, S. C., Air Base	3,675
Chain Belt Co., Milwaukee; rotary distributors	3,690
Chicago Pneumatic Tool Co., Los Angeles; riveters	50,093
electric drills	26,600
Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati; milling machines and cutters	9,696
Cincinnati Shaper Co., Cincinnati; shapers and vee belts	25,257
Clamshell Bucket Sales Corp., Long Island City, N. Y.; clamshell and dragline buckets	8,730
Consolidated Steel Warehouse Co., Philadelphia; structural steel	38,716
Dixie Mill Supply Co., New Orleans; machine shop equipment and supplies	4,188
Eichman Machinery Co., Kansas City; drill heads	2,677
English Brothers Machinery Co., Kansas City; riveting machines	8,955
Erie Steel Construction Co., New York; portable concrete mixing plant	9,385

AWARDS

Four Wheel Drive Auto Co., Clintonville, Wis.; boring machines and augers 171,922
Frick-Gallagher Mfg. Co., Wellston, Ohio; rotabins 2,475
Fuchs Machinery & Supply Co., Omaha, Neb.; punches, dies, etc. 8,238
Gale Service & Construction Co., Chicago; boiler washing systems 23,065
General Fire Truck Corp., New York; fire extinguishing equipment and supplies 5,269
fire fighting equipment 2,469
Graybar Electric Co., Inc., New York; construction equipment and tools 2,062
W. & L. E. Gurley, Troy, N. Y.; precise transits 14,835
Melville B. Hall, Inc., St. Louis; copper wire and cable 4,398
Hertzel Steel Form & Iron Co., Warren, Ohio; paving road forms 2,564
L. E. Hoback, Everett, Wash.; rental of dump trucks 2,192
Independent Pneumatic Tool Co., Chicago; pneumatic drills and accessories 15,568
Industrial Electrical Works, Omaha, Neb.; punches, dies, etc. 8,965
Ingersoll-Rand Co., Washington; air compressors and parts 15,901
riveters 22,162
Kearney & Trecker Corp., Milwaukee; milling machines and parts 53,358
E. B. Kelley Co., Inc., Long Island City; replacement parts for centrifugal pumps 2,285
Kewanee Boiler Corp., Kewanee, Ill.; riveted firebox boilers 9,421
E. L. Kirschner Co., San Francisco; line fencing, posts and gates 5,969
Kohler Co., Kohler, Wis.; generating sets, tanks, fuel 17,560
Landis Machine Co., Inc., Waynesboro, Pa.; threading machines.. 8,985
Landis Tool Co., Waynesboro, Pa.; hydraulic universal grinders ... 5,061
Lee & Thatro Equipment Co., Los Angeles; street sweepers 6,300
Manning, Maxwell & Moore, Inc., Jersey City; drill presses, punches and shears 3,460
Marion Steam Shovel Co., Marion, Ohio; shovels and parts 86,017
A. Y. McDonald Mfg. Co., Dubuque, Iowa; pumping sets, deep well.. 2,468
McMaster-Carr Supply Co., Chicago; nuts 8,957
Mine Smelter Supply Co., Denver; structural steel 3,572
C. C. Moore & Co., Engineers, Inc., San Francisco; Steam Boiler Plant, Sacramento Air Depot .. 238,965
Norton Co., Worcester; tool and cutter grinders 2,633
O'Brien & Co., St. Paul, Minn.; chlorinators and flow meters .. 4,601
Pacific Refrigeration Co., Los Angeles; quench tank refrigeration system 2,783
W. H. Peepels Co., Inc., Long Island City, N. Y.; fabricated duct work and grilles 2,448
H. O. Penn Machinery Co., Inc., New York; diesel motor for use on tractor 2,205
attachments for tractors 4,050
Philadelphia Tramrail Co., Philadelphia; overhead hoists and parts 9,765
Pressed Steel Car Co., Inc., Pittsburgh; rails, splice bars and ties 14,836
Price Brothers Co., Dayton, Ohio; bottom dump wagon hauling units 15,232
"Quick-Way" Truck Shovel Co., Denver; parts for cranes 43,216
Remington Rand, Inc., Buffalo; tabulating equipment 104,940
Republic Steel Corp., Canton, Ohio; shelving units and drawer units 23,765
Revere Copper & Brass, Inc., Baltimore; brass sheet 10,601
Rhodes Equipment Co., St. Louis; single retord underfeed stokers. 3,779
John A. Roeblings Sons Co., Washington; rope, wire 2,575

Joseph T. Ryerson & Son, Inc., Jersey City; machine, spring forming 2,234
iron staybolts 2,946
bending rolls 16,242
Sharples Corp., Philadelphia; oil purifiers and parts 2,155
Sidney Machine Tool Co., Sidney, Ohio; lathes 4,544
Stegal Machine Works, Council Bluffs, Iowa; corner round dies and end trim dies 5,880
Taylor-Wharton Iron & Steel Co., Easton, Pa.; oxygen cylinders.. 13,056
Union Twist Drill Co., Derby Line, Vt.; taps 1,645
Oliver H. Van Dorn Co., Inc., New Orleans; machine shop equipment and tools 3,180
Warren Pipe Co. of Mass., Inc., Boston; pipe and fittings 5,831
Watson-Stillman Co., Roselle, N. J.; hydraulic presses 2,280
Webber Motor Car Co., Inc., Westwood, N. J.; station wagons .. 2,346
Well Machinery & Supply Co., Inc., Ft. Worth, Texas; double drum hydraulic cranes 13,158
link belt car spotters 2,280
Whiting Corp., Harvey, Ill.; Whiting cupola and accessories 6,458
tables, drop, pit, railroad 19,320
Wickwire Spencer Steel Co., New York; chain link fence, Jacksonville, Fla., Airport 6,502

War Dept., Air Corps:

Aro Equipment Corp., Bryan, Ohio; propeller hubs $442,017
Bardco Mfg. & Sales Co., Dayton, Ohio; gasoline engine generator units 122,995
Biederman Motors Corp., Cincinnati; truck-tractors 1,996,860
Boeing Aircraft Co., Seattle; parts for airplanes 74,684
Curtiss-Wright Corp., Curtiss Propeller Division, Caldwell, N. J.; parts for propellers 164,409
Fanco Machine Co., Racine, Wis.; presses 16,400
General Motors Corp., New York; hardware 450,129
Greenerd Arbor Press Co., Nashua, N. Y.; presses 3,560
Hayes Industries, Inc., Jackson, Mich.; parts for Hayes Type Equipment 175,058
Heil Company, Milwaukee; oil servicing trucks 2,620,584
Lamson & Sessions Co., Cleveland; bolts 51,276
M. D. Larkin Co., Dayton, Ohio; presses 15,655
Lawson Mfg. Co., Pittsburgh; stand assemblies, engine overhaul, radial engines 167,487
Machinery & Specialties, Inc., Philadelphia; presses 915
Packard Motor Car Co., Detroit; tool kit assemblies 75,428
Vickers, Inc., Detroit; pump assemblies 29,600
K. R. Wilson, New York; presses. 39,448
Yale & Towne Mfg. Co., Stamford, Conn.; pumps and motors 487,734

War Dept., Quartermaster Corps:

American Seating Co., Grand Rapids, Mich.; chairs, folding, metal $3,485
Bauer-Smith Dredging Co., Port Lavaca, Texas; steel, diesel driven ferry boats 49,540
Cestone Brothers, Inc., Verona, N. J.; improvements to Sewer System at Reception Center, Ft. Dix, N. J. 13,258
Chrysler Corp., Parts Division, Highland Park, Mich.; parts for trucks 242,062
General Motors Sales Corp., Chevrolet Division, Detroit; parts for trucks 288,439
General Motors Truck & Coach Division, Yellow Truck & Coach Motor Co., Pontiac, Mich.; parts for trucks 100,920
Harnischfeger Corp., Milwaukee; crawler cranes 35,220
Mack Mfg. Corp., Plainfield, N. J.; parts for trucks 359,049

War Dept., Signal Corps:

Antonelli Fireworks Co., Rochester, N. Y.; ammunition $1,005,000
Graybar Electric Co., New York; wire 44,176

War Dept., Medical:

Liberty Foundry Co., St. Louis; tables $29,112
Ransom & Randolph Co., Toledo, Ohio; burs 11,155
J. Sklar Mfg. Co., New York; forceps 6,027

Defense Plant Building:

Aetna Ball Bearing Mfg. Co., Chicago; additional machinery and equipment for mfg. propeller roller thrust bearings $410,565
John Bath & Co., Inc., Worcester; machinery and equipment for ordnance mfg. 405,000
W. L. Brubaker & Brothers Co., Millersburg, Pa.; machinery and equipment for machine tool plant 54,946
Combustion Engineering Co., St. Louis; additional machinery and equipment for mfg. nitric acid producing units 18,000
General Alloys Co., Boston; additional plant facilities for mfg. alloy castings 91,163
General Ceramics & Steatite Corp., Keashey, N. J.; facilities for mfg. steatite insulators 132,875
General Electric Co., Fort Wayne, Ind.; additional plant and machinery for mfg. turbo superchargers and geared impellers.. 25,011,838
Hanson-Whitney Machine Co., Hartford; machinery and equipment for ordnance plant 263,777
A. W. Hecker, Cleveland; additional machinery and equipment for mfg. castings and forgings for military aircraft 199,130
Otis Elevator Co., New York; machinery and equipment for aeronautical plant 147,567
Thompson Aircraft Products Co., Cleveland; additional facilities for mfg. aircraft parts and aircraft engine parts 1,589,433
Titeflex Metal Hose Co., Newark; additional facilities for radio equipment plant 198,000
United Drill & Tool Corp., Chicago; construction and equipment of ordnance plant 1,942,701
Wayne Tool Co., Waynesboro, Pa.; machinery and equipment for ordnance plant 60,000
Wood Newspaper Machinery Corp., Plainfield, N. J.; machinery and equipment for ordnance plant .. 335,952
Wright Aeronautical Corp., East Paterson, N. J.; additional plant and equipment for mfg. aircraft engines 4,974,200

PERSONALS . . .

• **R. W. Gemmell** has been appointed to the staff of the emergency products division of the Westinghouse Electric & Mfg. Co., East Pittsburgh, to supervise government negotiations involving ordnance equipment and special defense products. Mr. Gemmell joined Westinghouse in 1926 and worked as a railway equipment engineer until 1932. For the next seven years, he served in transportation engineering and sales, and since 1939 has been in charge of aviation sales.

• **William M. Work** has been appointed supervisor of office systems of the district manufacturing and repair department of Westinghouse. He joined the company in 1922 and was assigned to the George Cutter Works at South Bend, Ind., until 1928. He then served in various capacities in district and East Pittsburgh offices of the sales department until 1939, when he began a series of special assignments at the East Pittsburgh works.

• **Armand T. Chandonnet,** for the past three years manager and treasurer of the Elmira Foundry Co., Inc., Elmira, N. Y., an affiliate of the General Electric Co., Schenectady, has been named coordinator of aircraft turret manufacture in all G-E plants. **N. Harold Boardman,** with Elmira Foundry since 1917, will succeed Mr. Chandonnet as head of that company. Mr. Chandonnet entered the employ of General Electric after graduating from Tufts College. He served on the staff of the General Electric vice-president in charge of manufacturing, handling special assignments. In 1938, he was appointed assistant manager of the Elmira Foundry Co. and a year later became manager and treasurer of that company. Mr. Boardman had been assistant to Mr. Chandonnet as well as general foreman and metallurgist of the Elmira Foundry Co.

• **William S. Wilbraham,** who has been manager of sales of Lukenweld, Inc., Coatesville, Pa., has been promoted to manager of costs. **Robert C. Sahlin,** who has been assistant manager of sales of Lukenweld, Inc., has been promoted to manager of sales.

• **William P. Andrews** has been made manager of sales, Cleveland district, Carnegie - Illinois Steel Corp. He formerly was manager of sales in the Cincinnati district and succeeds **F. R. Gammon** who was recently appointed manager of sales, New York sales office. Mr. Andrews has been with U. S. Steel Corp. subsidiaries since 1921 when he was weigh-master at the Gary tin mills of the former American Sheet & Tin Plate Co. After two years as a sales student, he was appointed a sales representative in New York. He later served in the same capacity in Chicago and Minneapolis and in 1934 was made assistant manager of sales in the Chicago district.

• **Herman P. Hess,** plant superintendent of Wilcox-Rich division, Eaton Mfg. Co., Saginaw, Mich., has been promoted to general superintendent. At the same time **Lee C. Case,** purchasing agent was named production manager; **Carl E. Dilts,** engineering and drafting supervisor was named chief engineer; **John Decker,** assistant chief inspector plant No. 1 was named chief inspector of plant 2; **William C. Eib, Walter Ducharme** and **John A. Kolb,** foremen were named shift superintendents. The changes were preliminary to accelerating manufacture of aircraft engine parts.

• **A. A. Gustafson** has recently been appointed director of personnel and safety of the Buda Co., Harvey, Ill. He has had 15 years practical experience with manufacturing concerns in the Chicago area, namely, with the Anderson Co. of Gary, Ind., Hubbard Steel Foundry Co. of East Chicago, Ind., B. F. Gump Co., Chicago, Schwietzer-Conrad Co., Chicago. For the last year and a half he was employed by the federal government as a safety engineer.

• **E. R. Goss** has been promoted to branch manager of the El Paso, Tex., office of Chicago Pneumatic Tool Co., succeeding E. J. Coughlin, former manager of the branch, who was killed in an automobile accident Oct. 14. Mr. Goss started with Chicago Pneumatic Tool Co. in 1929 at its El Paso office. He was transferred to the Los Angeles branch office in 1933 and returned to the El Paso branch again in 1937. He was located at Phoenix, Ariz., until the present time.

• **Harold C. Richardson,** assistant superintendent of the Porter-Cable Machine Co., Syracuse, N. Y., has been given an extended leave of absence to work with the New York division of the Contract Distribution Section of OPM. He assumed his new duties on Dec. 1.

• **J. E. von Maur** has been appointed representative in southern Ohio of the American Gas Furnace Co., Elizabeth, N. J., with offices at 63 South High Street, Columbus, Ohio. **Earle S. Dudley,** succeeds W. F. Faber as the company's representative in eastern New York State.

• **Armand Theodore Mercier** has been elected president of the Southern Pacific Co. at a meeting of the railroad's board of directors in San Francisco. He succeeds the late A. D. McDonald. Mr. Mercier has been with the company 38 years and has occupied the post of vice-president since 1938.

• **William H. Addis,** 2344 Cumberland St., Houston, Tex., has been appointed representative for the Ajax Electric Co., Inc., Philadelphia, in the Southwestern territory.

• **John H. O'Sullivan** has been named district sales manager of the Peninsular Grinding Wheel Co., Detroit, manufacturers for over 50 years. He will make his headquarters in Detroit.

• **Hazel M. Hakalow** has been elected president and treasurer of the General Welding Co., Detroit. Mrs. Hakalow succeeds her husband, the late John S. Hakalow, founder of the firm. She has been in active charge of the company since her husband's death last November. **Michael Hakalow** has been made vice-president and sec-

retary. He has been associated with the company since its establishment 15 years ago.

• **R. W. Keller** has been made vice-president and assistant general manager of the Milton Bradley Co., Springfield, Mass. **W. O. Lippman,** who was reported to have become associated with the Milton Bradley Co., is still manager of the East Springfield plant of the Westinghouse Electric & Mfg. Co.

This information was incorrectly stated in THE IRON AGE last week.

Induction Heating Applied To Hardening A.P. Shells

Cleveland

• • • **Technical circles here** reveal that the Tocco division of the Ohio Crankshaft Co. has developed a revolutionary method of hardening shot through induction-heating, thereby giving artillery shot unusual armor-piercing qualities. Although company officials have been unable to comment on this development because of Army censorship, the process is known to be used at various plants to harden 37-mm. armor piercing shell at a cost of less than 1c. per lb. at the rate of as many as 200 pieces per hour. It is reported that Canadian tests reveal that Tocco-hardened shot has greater penetrating power than shot hardened by any other method.

The shot is placed in small Tocco machines, requiring a floor space of less than 6 ft. square, where high frequency inductors bring the object to a unform red heat extending to a predetermined depth. After a few seconds, an automatic water spray within the Tocco unit quenches the shot, giving it a hard shell and an internal structure less susceptible to shattering on impact.

The company is reported to be building machines to harden 75-mm. shot.

Lend-Lease Steel Aid 1,361,942 Tons, November

• • • **Iron and steel** products transferred under lend-lease aid up to Nov. 30 totaled 1,361,942 tons, according to a report made to Congress on Monday by the Lend-Lease Administration. Non-ferrous metals transferred amounted to 63,012 tons.

OBITUARY . . .

• **William H. Winterrowd,** vice-president in charge of operations and a director of the Baldwin Locomotive Works, Philadelphia, died Dec. 7, in the Bryn Mawr Hospital, following an automobile accident. In 1912 Mr. Winterrowd went to the Canadian Pacific Railroad as mechanical engineer where in 1915 he became assistant chief mechanical engineer. During the World War, after converting part of the railroad's largest shop into a munitions plant, he went to Russia with Sir George Bury, vice-president of the Canadian Pacific, as a member of Lord Milner's mission. Upon his return in 1918, Mr. Winterrowd was made chief mechanical engineer of the Canadian Pacific.

Mr. Winterrowd joined the Lima Locomotive Works, Inc., in 1923, as assistant to the president and in 1927 he was made vice-president of that company. In 1934 he became vice-president of the Franklin Railway Supply Co., which position he left in 1939 to become vice-president in charge of operations of The Baldwin Locomotive Works. In this capacity he directed the production of the many items of ordnance material being manufactured by Baldwin, including medium and heavy tanks.

• **Hoyt Shepard,** aged 50, assistant to the general sales manager of the Continental Steel Corp., Kokomo, Ind., died suddenly of a heart attack at the St. Joseph's Hospital, Dec. 4. Mr. Shepard entered the employ of the Chapman-Price Steel Co., Indianapolis, in 1921, and transferred to Kokomo in 1928 when that company merged with the Continental Steel Corp.

• **Alexander L. Reichstein,** connected with the Meyer Reichstein Scrap Iron Co., Detroit, died recently at the age of 57.

• **Douglas W. Galloway,** sales engineer for Motch & Merryweather Co., machinery dealers in Detroit, died of a heart attack in Fond du Lac, Wis., while on a business trip. He was 41 years old.

• **Frederick W. Marks,** 72 years old, vice-president and secretary-treasurer of the A. T. Ferrell Co., died recently.

• **John A. Calder,** transferred recently from Buffalo to Grand Rapids, Mich., to become personnel manager of the Grand Rapids Stamping Division, General Motors Corp., was killed by an automobile in Grand Rapids as he crossed the street, recently. He was 41 years old.

The late William H. Winterrowd, vice-president in charge of operations and a director of the Baldwin Locomotive Works, Philadelphia.

• **Albert S. Harvey,** 51 years old, president of the United States Graphite Co., died recently at his home in Saginaw. Mr. Harvey also was president of Wallace & Morley Co. and the Wallace Stone Co., of Bayport, Mich. He was a former president of the Saginaw Chamber of Commerce.

• **Warren Maenak,** vice-president and general manager of the Camden Forge Co., Camden, N. J., died December 8.

• **George M. Johnson,** associated for many years with the Reliance Foundry Co. of Cincinnati as treasurer and a member of the board of directors, died at the age of 65.

Body Plant Idle

• • • **A temporary** lay-off of 3000 workers which was effected Dec. 11 at the Fisher Body Division of General Motors Corp. here, is expected to end Dec. 29, by which time production lines will be readjusted to permit simplification of new automobile models and elimination of chrome trim and bright work.

Exports of Iron and Steel Rise to 706,580 Tons in September

• • • **Exports of iron** and steel products, including scrap, continued to rise in September to 706,580 gross tons compared with 697,732 tons in August, according to the Department of Commerce. Exports for the nine months amounted to 5,374,781 tons against 7,904,546 tons in the comparable period of 1940.

Showing an increase over August, September imports of iron and steel products totaled 4230 gross tons compared with 1975 tons in August. Imports of scrap iron, and steel dropped sharply to 4259 tons from the August total of 16,405 tons.

September Iron Ore Imports Drop to 205,984 Gross Tons

• • • **Iron ore imports** for September dropped to 205,984 gross tons from 223,455 tons in August, according to the Department of Commerce. Chile, shipping 121,800 gross tons, continued to be the chief source. Total manganese ore imported in September was 61,957 compared with 64,787 tons in August, with Brazil leading with 20,497 tons. Details of September ore imports follow:

	(Gross Tons)	
Iron ore		205,984
United Kingdom	50	
Canada	45,672	
Mexico	488	
Newfoundland and Labrador	12,366	
Cuba	15,908	
Brazil	9,700	
Chile	121,800	
Manganese ore (35% and over)		61,957
Battery grade:		
Gold Coast	1,081	
Other:		
Cuba	13,604	
Brazil	20,497	
Chile	911	
British Indies	9,642	
Philippines Islands	1,051	
Union of South Africa	2,668	
Gold Coast	12,503	

IMPORTS
(Gross Tons)

September		Nine Months Ended September		
1941	1940	1941	1940	
....	1,830	....	9,554	Pig iron
2,537	25	5,874	17,743	Ferromanganese and Spiegeleisen[1]
246	137	2,648	1,009	Ferrochrome and ferrosilicon[1]
1	....	2	215	Other ferroalloys[1]
....	....	23	610	Sponge iron
4,259	56	46,975	1,484	Scrap: iron, steel, tin plate
7,043	*2,048*	*55,522*	*30,615*	*Pig iron, ferroalloys and scrap*
877	....	994	440	Ingots, blooms, billets, sheet bars
*	....	....	....	Ingots, etc.: stainless, other alloy
*	....	....	....	Skelp
....	37	105	3,986	Wire rods
877	*37*	*1,099*	*4,426*	*Semi-finished steel*
2	2	47	115	Sheets, black iron and steel[2]
*	....	....	....	Sheets, galvanized iron and steel
*	....	....	....	Sheets, alloy steel
*	....	....	....	Sheets, stainless
1	....	50	10	Plates, plain and fabricated
*	....	....	....	Plates, alloy
*	....	....	....	Plates, stainless
64	11	363	1,806	Bars, merchant and reinforcing
....	....	15	194	Bars, iron[3]
*	....	....	....	Bars, alloy steel
*	....	....	....	Bars, stainless
43	1	203	855	Bars, hollow steel
....	2	....	614	Hoops, bands, strips, cotton ties
*	....	....	....	Hoops, bands, strip: alloy steel
*	....	....	....	Hoops, bands, strip: stainless
....	....	....	....	Piling, sheet
16	....	77	710	Structural shapes
19	....	211	16	Structural material, fabricated[4]
26	11	95	89	Tin plate, terne plate, taggers' tin
*	....	....	....	Tanks, steel
....	....	....	31	Pipe, welded iron and steel
13	336	761	2,685	Casing and oil line pipe
*	....	....	....	Boiler tubes
1	34	30	883	Wire, round iron and steel, telephone
2	4	94	490	Wire rope, strand, other products
....	....	....	86	Wire barbed, woven products
43	47	2,216	2,056	Wire flat, all other types
1	1	24	107	Nails, tacks and staples
2	1	30	129	Bolts, nuts, rivets, washers, etc.
305	1	4,419	1,445	Rails and track material
2	....	11	12	Die blocks or blanks, etc.
....	....	....	3	All other finished steel
540	*451*	*8,646*	*12,336*	*Rolled and finished steel*
....	....	....	419	Cast iron pipe and fittings
....	27	....	29	Malleable iron pipe fittings
29	35	252	468	Casting, forgings: iron and steel
*	....	....	....	Castings, forgings: alloy and stainless
*	....	....	....	Carwheels and axles
29	*62*	*252*	*916*	*Castings and forgings*
8,489	2,598	65,519	48,293	Total

EXPORTS
(Gross Tons)

September		Nine Months Ended September		
1941	1940	1941	1940	
26,331	84,677	458,537	406,751	Pig iron
351	611	3,003	11,800	Ferromanganese and Spiegeleisen[1]
*	.....	.....	.....	Ferrochrome and ferrosilicon[1]
759	5,441	15,020	17,015	Other ferroalloys[1]
*	.....	.....	.....	Sponge iron
65,486	255,608	621,526	2,417,534	Scrap: iron, steel, tin plate
92,927	*346,337*	*1,098,086*	*2,853,100*	*Pig iron, ferroalloys and scrap*
328,662	353,448	1,293,723	1,590,071	Ingots, blooms, billets, sheet bars
20,113	38,576	292,276	67,946	Ingots, etc.: stainless, other alloy
8,770	19,817	114,974	84,693	Skelp
18,113	50,891	118,547	217,061	Wire rods
375,658	*462,732*	*1,819,520*	*1,959,771*	*Semi-finished steel*
29,693	36,543	306,028	376,702	Sheets, black iron and steel[2]
7,057	13,534	77,166	129,607	Sheets, galvanized iron and steel
1,146	302	10,188	4,113	Sheets, alloy steel
113	123	882	1,338	Sheets, stainless
25,837	65,166	296,244	407,042	Plates, plain and fabricated
246	109	8,215	1,828	Plates, alloy
13	67	197	398	Plates, stainless
26,125	70,917	338,588	485,455	Bars, merchant and reinforcing
834	1,062	3,645	11,480	Bars, iron[3]
5,351	3,585	59,563	22,657	Bars, alloy steel
122	347	597	956	Bars, stainless
*	.....	.....	.....	Bars, hollow steel
11,021	17,271	111,297	145,524	Hoops, bands, strips, cotton ties
754	172	1,987	1,308	Hoops, bands, strip: alloy steel
70	39	432	610	Hoops, bands, strip: stainless
1,106	1,260	5,569	10,228	Piling, sheet
17,881	69,470	195,027	275,022	Structural shapes
2,508	6,115	38,794	55,289	Structural material, fabricated[4]
27,418	15,683	198,442	334,417	Tin plate, terne plate, taggers' tin
459	2,147	14,787	21,946	Tanks, steel
11,967	9,318	107,097	82,703	Pipe, welded iron and steel
17,013	20,962	115,491	147,063	Casing and oil line pipe
1,475	3,173	40,142	18,795	Boiler tubes
5,737	10,017	52,668	68,864	Wire, round iron and steel, telephone
1,845	1,144	13,421	9,501	Wire rope, strand, other products
4,305	3,584	48,611	33,673	Wire barbed, woven products
10,313	12,979	91,985	100,711	Wire flat, all other types
947	458	8,482	5,450	Nails, tacks and staples
3,713	5,434	31,503	20,575	Bolts, nuts, rivets, washers, etc.
6,260	30,654	132,962	198,641	Rails and track material
*	.....	.....	.....	Die blocks or blanks, etc.
3,297	1,362	23,988	15,919	All other finished steel
224,626	*402,997*	*2,333,998*	*2,987,815*	*Rolled and finished steel*
2,163	3,912	44,545	56,966	Cast iron pipe and fittings
364	391	3,742	3,323	Malleable iron pipe fittings
6,459	3,357	48,627	27,043	Casting, forgings: iron and steel
415	296	6,018	4,053	Castings, forgings: alloy and stainless
3,968	1,030	20,245	12,475	Carwheels and axles
13,369	*8,986*	*123,177*	*103,860*	*Castings and forgings*
706,580	1,221,052	5,374,781	7,904,546	Total

[1] In imports the tonnage shown is the alloy content: the manganese, chromium and silicon content, as the case may be. [2] Imports include skelp and saw plate. [3] Import figure included iron slabs. [4] Imports include sashes and frames only.
* No separate figures.

CONSTRUCTION STEEL

. . . STRUCTURAL STEEL, REINFORCING BARS, PLATES, PILING, ETC.

Pipe Lines

Lone Star Gas Co., 1915 Wood Street, Dallas, Tex., plans 12-in. welded steel pipe line from Sewell gas field, near Olney, Tex., to connection with main system, about 28 miles, for natural gas transmission. Cost over $130,000 with booster station and other operating facilities.

Skelly Oil Co., 605 West Forty-seventh Street, Kansas City, Mo., plans welded steel pipe line from Barada, Neb., to Falls City, Neb., about 10 miles, for crude oil transmission, including new pumping station for booster service at Barada.

Standard Oil Co. of Louisiana, 2134 St. Charles Avenue, New Orleans, plans new 10-in. welded steel pipe line from oil field district at Tinsley, Miss., to Baton Rouge, La., for crude oil transmission for oil refining plant at latter place. Construction will be carried out by pipe line affiliate of company.

Sinclair Refining Co., 630 Fifth Avenue, New York, has let contract to O. C. Whitaker Co., 2441 East King Street, Tulsa, Okla., for new welded steel pipe line from oil refinery at Marcus Hook, Pa., to Greensburg, Pa., about 20 miles from Pittsburgh, for gasoline transmission, totaling about 380 miles in all; also for branch pipe line from point near Reading, Pa., to Baltimore, close to 95 miles, for similar service. Installation will include eight pumping stations for booster service and other operating facilities. New tank terminal will be located at Greensburg for service in Pittsburgh district.

United States Engineer Office, New York district, 17 Battery Place, asks bids until Dec. 22 for 30 lengths of butt welded, 20-in. steel plate flanged discharge pipe (Circular 149).

Wisconsin Gas Transmission Co., affiliated with Independent Natural Gas Co., 735 North Water Street, Milwaukee, both subsidiaries of Phillips Petroleum Co., Bartlesville, Okla., plans new welded steel pipe line from gas field in Moore County, Tex., to Milwaukee and vicinity, about 918 miles, for natural gas transmission for local distribution for indus-

November Steel Output at 98.3 Per Cent.

(See THE IRON AGE, Dec. 11, for Other Details)

	STEEL INGOT OUTPUT IN NET TONS					PER CENT OF CAPACITY			
	Open Hearth	Bessemer	Electric	Total	Weekly Output	Open Hearth	Bessemer	Electric	Total
1940									
January	5,356,444	285,447	122,832	5,764,723	1,301,292	85.7	56.1	77.0	83.4
February	4,208,249	205,458	112,090	4,525,797	1,093,188	72.1	43.2	75.2	70.0
March	4,078,843	191,568	118,772	4,389,183	990,786	65.3	37.6	74.5	63.5
1st Quarter	*13,643,536*	*682,473*	*353,694*	*14,679,703*	*1,129,208*	*74.4*	*45.7*	*75.6*	*72.3*
April	3,808,031	176,419	116,024	4,100,474	955,821	62.9	35.8	75.1	61.2
May	4,583,771	258,741	125,270	4,967,782	1,121,395	73.4	50.8	78.5	71.8
June	5,222,120	305,115	130,208	5,657,443	1,318,751	86.3	61.9	84.3	84.5
2nd Quarter	*13,613,922*	*740,275*	*371,502*	*14,725,699*	*1,131,875*	*74.2*	*49.5*	*79.3*	*72.5*
1st 6 months	*27,257,458*	*1,422,748*	*725,196*	*29,405,402*	*1,130,542*	*74.3*	*47.6*	*77.4*	*72.4*
July	5,269,701	322,567	132,357	5,724,625	1,295,164	84.5	63.5	83.2	83.0
August	5,670,932	369,770	145,681	6,186,383	1,396,475	90.8	72.6	91.3	89.5
September	5,535,198	365,289	155,759	6,056,246	1,415,011	91.7	74.2	101.1	90.6
3rd Quarter	*16,475,831*	*1,057,626*	*433,797*	*17,967,254*	*1,368,412*	*89.0*	*70.1*	*91.7*	*87.7*
9 months	*43,733,289*	*2,480,374*	*1,158,993*	*47,372,656*	*1,210,339*	*79.2*	*55.1*	*82.2*	*77.5*
October	6,059,792	408,317	176,433	6,644,542	1,499,897	97.0	80.2	110.6	96.1
November	5,872,162	420,448	176,497	6,469,107	1,507,950	97.1	85.3	114.2	96.6
December	5,907,840	399,434	188,083	6,495,357	1,469,538	94.8	78.6	118.2	94.1
4th Quarter	*17,839,794*	*1,228,199*	*541,013*	*19,609,006*	*1,492,314*	*96.3*	*81.3*	*114.3*	*95.6*
Total	*61,573,083*	*3,708,573*	*1,700,006*	*66,981,662*	*1,281,210*	*83.5*	*61.7*	*90.3*	*82.1*
1941									
January	6,276,429	451,637	200,019	6,928,085	1,563,902	99.1	76.0	91.0	96.9
February	5,673,289	378,330	186,281	6,237,900	1,559,475	99.2	70.5	93.9	96.6
March	6,461,936	460,169	209,536	7,131,641	1,609,851	102.0	77.4	95.4	99.7
1st Quarter	*18,411,654*	*1,290,136*	*595,836*	*20,297,626*	*1,578,353*	*100.1*	*74.8*	*93.4*	*97.8*
April	6,135,941	395,009	225,999	6,756,949	1,575,046	100.0	68.6	106.2	97.6
May	6,365,172	444,361	243,705	7,053,238	1,592,153	100.5	74.8	110.9	98.7
June	6,103,767	458,242	238,721	6,800,730	1,585,252	99.5	79.6	112.2	98.2
2nd Quarter	*18,604,880*	*1,297,612*	*708,425*	*20,610,917*	*1,584,237*	*100.0*	*74.3*	*109.8*	*98.2*
1st 6 months	*37,016,534*	*2,587,748*	*1,304,261*	*40,908,543*	*1,581,312*	*100.1*	*74.5*	*101.6*	*98.0*
July	6,089,859	489,239	242,584	6,821,682	1,543,367	94.4	85.0	87.4	93.4
August	6,243,100	495,523	262,334	7,000,957	1,580,351	96.6	85.9	94.4	95.7
September	6,058,731	500,687	260,288	6,819,706	1,593,389	97.0	89.8	96.9	96.4
3rd Quarter	*18,391,690*	*1,485,449*	*765,206*	*20,642,345*	*1,572,151*	*96.0*	*86.8*	*92.9*	*95.2*
9 months	*55,408,224*	*4,073,197*	*2,069,467*	*61,550,888*	*1,578,228*	*98.7*	*78.6*	*98.2*	*97.0*
October	6,427,977	532,863	281,843	7,242,683	1,634,917	99.4	92.3	101.4	99.0
November	6,198,368	488,986	282,633	6,969,987	1,624,706	99.0	87.5	105.0	98.3

Source: American Iron and Steel Institute. The percentages of capacity operated in the first six months are calculated on weekly capacities of 1,430,102 net tons open hearth, 134,187 net tons bessemer and 49,603 net tons electric ingots and steel for castings, total 1,613,892 net tons; based on annual capacities as of Dec. 31, 1940 as follows: Open hearth 74,565,510 net tons, bessemer 6,996,520 net tons, electric 2,586,320 net tons. Beginning July 1, 1941, the percentages of capacity operated are calculated on weekly capacities of 1,459,132 net tons open hearth, 130,292 net tons bessemer and 62,761 net tons electric ingots and steel for castings, total 1,652,185 net tons; based on annual capacities as of June 30, 1941 as follows: Open hearth, 76,079,130 net tons, bessemer 6,793,400 net tons, electric 3,272,370 net tons.

Strategic Data Is Dropped by Iron Age With U.S. at War

• • • Specific tonnages and locations of projects in structural steel and reinforcing bar awards usually carried on this page will, for the time being, be omitted from THE IRON AGE.

This publication takes this step voluntarily because it believes information of that type is useful to the enemy in reaching conclusions about the industrial war machine now being set up in the U. S.

Total tonnages of structural and reinforcing steel awards will be published as long as these are available but details will not be carried.

Weekly Bookings of Construction Steel

Week Ended →	Dec. 16, 1941	Dec. 9, 1941	Nov. 18, 1941	Dec. 16, 1940	Year to Date 1941	Year to Date 1940
Fabricated structural steel awards	18,700	16,400	13,950	35,450	1,265,470	1,128,710
Fabricated plate awards	0	2,355	9,115	255	139,200	143,200
Sheet steel piling awards	0	0	0	0	26,760	65,630
Reinforcing bar awards	20,000	8,600	2,825	6,110	699,655	459,305
Total letting of Construction Steel	38,700	27,355	25,890	41,815	2,131,085	1,796,945

trial and other services: about 818 miles of total distance will be 22-in. pipe, and remainder, in Wisconsin, 20-in. Cost over $8,000,000 with booster stations and other operating facilities, including meter and control stations at terminal points.

Cast Iron Pipe

Chicopee, Mass., contemplates a 30-in. water main between that city and Springfield, Mass. Federal funds will be granted for part payment.

Water Department, Hamilton, Mass., plans pipe line extensions in water system and other waterworks installation. Cost about $60,000. Morse, Dickinson & Goodwin, 25 Washington Square, Haverhill, Mass., are consulting engineers.

Water Department, Wheeling, W. Va., plans pipe line extensions in water system and other waterworks installation. Fund of $117,492 has been secured through Federal aid.

Aberdeen, Ohio, plans pipe lines for water system and other waterworks installation. Cost about $40,000. Financing in part will be arranged through federal aid.

Water Department, Galveston, Tex., plans pipe lines for water system and other waterworks installation, including about seven miles of 12 to 30-in. for main line; also a submerged pipe line to Pelican Spit district and local distribution lines. Project will include an elevated steel tank on steel tower, and new pumping station. Cost about $1,000,000, of which $500,000 will be represented by bond issue and like sum secured through federal aid. Ford, Bacon & Davis, Inc., City Hall, is consulting engineer.

Salina, Okla., plans pipe line extensions in water system and other waterworks installation. Cost about $75,000. Financing is being arranged through federal aid. H. T. Lawrence, 3244 N.W. Fourteenth Street, Oklahoma City, Okla., is engineer.

Hawkins, Tex., will ask bids soon for water pipe lines, including pumping machinery and other waterworks equipment. Cost about $55,000. Albert C. Moore & Co., Smith-Young Tower Building, San Antonio, Tex., are consulting engineers.

Defense Public Works Office, Los Angeles, has awarded to United States Pipe & Foundry Co., San Francisco, following material for San Diego water system: 5600 ft. of 16-in. (Class 200), 36,000 ft. of 16-in. (Class 250), 1000 ft. of 16-in. ball joint (Class 250), 1000 ft. of 16-in. bolted (Class 250), and 32 tons of fittings.

San Diego, Cal., has opened bids on 6150 ft. of 24-in. (Class 150) and 2270 ft. of 24-in. (Class 200) cast iron pipe and fittings.

Cathlamet, Wash., has awarded approximately 350 tons of 3, 6, and 10-in. pipe and fittings to Hugh M. Purcell, Seattle, for United States Pipe & Foundry Co.

Public Works Officer, 11th Naval District, San Diego, Cal., asks bids Dec. 30 on improvements to Naval air station sewage disposal system Specification 10,640, involving 15,500 ft. of 10 to 20-in. bell and spigot and 5000 ft. of 18-in. flexible joint cast iron pipe.

MACHINE TOOLS

. . . SALES, INQUIRIES AND MARKET NEWS

Lack of Manpower Seen Retarding Tool Output

Chicago

• • • **Greatest obstacle** to the seven-day week in machine tool plants in this section is still that of manpower. This issue has been the paramount concern with producers since war broke out. No longer are potential price ceilings, the dealer set-up, or other questions of prime importance. Having operated at practically peak capacity right along, bolstered by the unanimous aim to seek any possible chance of squeezing out more shipments, greater production is the sole thought. But whether the men can be found to bring any quick response is doubtful. The easiest and most immediate method, of course, would be the increasing of individual workmen's hours, which some leaders believe the government will eventually have to sanction.

Bomber Plant Buys Lathes

Cleveland

• • • **OPM's** announcement of the sharp increase in the bomber program was accompanied by an order for 12 heavy duty turret lathes by a company in this area turning out parts for bombers. At the same time, it is reported that the Ohio Crankshaft Co., Cleveland, has been asked by Federal officials to double its present greatly expanded capacity. Machine tool dealers expect that orders which have been hanging fire for months, due to unexplained Federal uncertainty, will probably now be placed within the next few weeks. Moreover, the industry is preparing itself for the shock of new orders that is expected to fall within the next thirty days.

Nickell, Lewis Appointed To OPA Machinery Section

Washington

• • • **Two appointments** to the machinery section of the OPA were announced last week. Thomas P. Nickell, general manager of the LeRoy Plow Co., LeRoy, N. Y., will serve as a senior specialist in the farm equipment unit and Mark B. Lewis, independent dealer in used equipment, will serve as a senior specialist in the general and auxiliary machinery unit.

Study 7-Day Week

Cincinnati

• • • **Production continues** to be the chief objective among machine tool builders here as Washington seeks further defense material. While the desirability of a seven-day week continues to be talked about, so far local builders report no instructions for Washington to extend the working week. Most plants, however, have been using a seven day week in departments where temporary bottlenecks appeared, but as a general policy, this seven day week has not yet been adopted. New business continues to flow into the market and in many instances, in excess of plant shipments, so that backlogs are steadily increasing.

Industrial Gear Sales Decline in November

• • • **Industrial gear** sales in November showed a decline from the October level, according to the American Gear Manufacturers Association, but were 39.3 per cent above the volume of November a year ago.

The association's index of sales, which excludes automotive gears and high speed turbine drive gears, stood at 241 for November, as compared with 261 in October and 173 in November, 1940. Sales for the first 11 months of the current year have averaged 81.6 per cent above 11 months of 1940.

NON-FERROUS METALS

. . . MARKET ACTIVITIES AND PRICE TRENDS

7 Day Week Proposed

• • • **In the non-ferrous** metals industries unionized labor and management have announced their intention of an all-out program to increase the production of metals to its maximum in as short a time as possible. A seven day, three shifts a day, week program of operations in copper, zinc, and lead mines was recommended by the War Production Committee of the International Union of Mine, Mill, and Smelter Workers, of the C.I.O. This program, it was stated, can be carried out if improvements in conditions in mine management and labor relations are made.

First of the large producers to start the seven day, three shift week were the Anaconda Copper Co. and the Phelps Dodge Corp. The increased operations at Anaconda will yield an additional 2000 to 3000 tons of copper a month, and there will be an additional 1000 tons a month output from the Phelps Dodge properties. Anaconda's New Cornelia mine at Ajo, Ariz., has been on a seven day week basis for some time, and the Phelps Dodge mine at Morenci, Ariz., under development for the past five years, will begin full time operations within the next two weeks. The output of this mine is rated at 75,000 tons a year, and it is expected that production will be increased, through DPC aid, to 135,000 tons a year by late 1943.

Many holders of December certificates for copper were a little late in placing their orders, and are finding it difficult to find suppliers at this late date, especially suppliers who will sell copper at 12c. a lb.

OPM's public hearings in Washington on the possibilities of increasing copper production have been postponed from Dec. 12 to Dec. 18. At that time a large group of copper producers, governors of copper producing states, labor representatives in the industry, and government defense agencies concerned with copper will be invited to participate in the hearings.

A Super-Priority Board, headed by E. A. Tupper, was announced by OPM. The purpose of the board is to set up an inventory and requisition section for prompt acquisition of copper and other war materials, whenever normal sources of supply are inadequate. This board will supplement the priorities system when priority orders are insufficient to get needed material to the right place and at the right time.

In spite of the fact that the Singapore market has opened after a short lapse following the beginning of the war in the Pacific, domestic tin buyers cannot buy because the cost of the metal delivered here is in excess of the 52c. a lb. ceiling. Tin on board vessels awaiting shipment can be covered under marine war risk policies, but rates are increasing steadily. Late last week the rates were 10 per cent for Pacific and Panama delivery.

OPM requested tin importers and dealers to furnish complete statements of outstanding obligations, which, with U. S. Bureau of Mines, reports on consumption and stocks, will furnish necessary information as to where available tin can be located and where it is going.

Non-Ferrous Prices

(Cents per lb. for early delivery)

Copper, Electrolytic[1]	12.00
Copper, Lake	12.00
Tin, Straits, New York	52.00
Zinc, East St. Louis[2]	8.25
Lead, St. Louis[3]	5.70

[1] Mine producers' quotations only, delivered Conn. Valley. Deduct ¼c. for approximate New York delivery price. [2] Add 0.39c. for New York delivery. [3] Add 0.15c. for New York delivery.

Miscellaneous Non-Ferrous Prices

ALUMINUM, delivered: virgin, 99 per cent plus, 15c.-16c. a lb.; No. 12 remelt No. 2, standard, 14.50c. a lb. NICKEL electrolytic, 35c.-36c. a lb. base refinery, lots of 2 tons or more. ANTIMONY, prompt: Asiatic, 16.50c. a lb., New York; American, 13c. a lb., f.o.b. smelter. QUICKSILVER, $199 per flask of 76 lb. BRASS INGOTS, commercial 85-5-5-5, 13.25c. a lb.

SCRAP

. . . MARKET ACTIVITIES AND PRICE TRENDS

Dormant Materials Objective of OPM

• • • **Highlights of the** scrap iron and steel market include the growth of allocations, with a trend toward coordinating them closer with pig iron allocations; the likelihood of tighter control over grades which can be melted in electric furnaces, and a new drive toward dislodging dormant scrap. The changes which have been mapped in grade classifications are expected to be out soon.

Just as OPM opened an intensive campaign to draw scrap from households, stores and plants, lack of scrap was reported to have caused the shutting down of open hearths by Carnegie-Illinois Steel Corp. Further emphasizing the serious low level of scrap supplies are reports from other districts that curtailments in ingot output are imminent soon unless relief comes. In the light of these facts, the drive by OPM appears to be the most valuable step toward victory taken in the United States in the short period since the outbreak of the war. Householders, storekeepers and plant owners are to be appealed to through newspapers, the radio and other means. The necessity of appointing one individual in each company or organization as a scout to uncover dormant scrap will be stressed.

Success of the drive probably will have bearing on the extent to which the government uses its new power to seize stocks. Appealing to all holders of surplus metals supplies, including scrap, Donald M. Nelson, director of priorities, last week urged that his office be telegraphed giving the size of inventories and amounts that can be spared to assist war production.

With the automobile industry slowing up in conformity with OPM's ruling, with some agricultural implement plants down to part of a week's operations, and severe cuts ordered recently in a variety of consumer product industries, the amount of manufactured scrap coming out over the balance of this month and in early January probably will be lighter than usual, even after taking into consideration the normal seasonal slackness occasioned by the holidays. Railroad scrapping operations are light, of course. Normally the carriers do little rail lifting or car wrecking at this time of year, and they will do less than usual now.

•

PITTSBURGH—Some open hearth units at Carnegie-Illinois Steel Corp. here were forced off this week due to lack of scrap. The situation is said to be cumulative and if supplies are not forthcoming by next week it may be necessary to curtail operations further. Brokers are having extreme difficulty in picking up scrap supplies and inventories at some places are close to the vanishing point. Reports persist here that the OPA will soon require conclusive proof that a steel company in need of allocation orders for scrap must show that its production is 90 per cent on rated defense and war material. Otherwise, it is said, operations may be allowed to drop to a point just short of the amount needed to produce defense material only. Some sources take this report as an admission that the scrap situation is already entering dangerous ground.

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CHICAGO—All mills here have gone on record as requiring allocations of scrap within a month, or generally, less. Two of the biggest producers have asked for specific tonnages, and one, Inland Steel Co., was given 10,000 tons several weeks ago. Official announcement of tonnage allotted a second company, and request of definite tonnage by a third may be made by the time this appears in print. Partial changes in the set-up of official control on scrap are anticipated very shortly. Although no details have been divulged, it is almost certain that the present cast arrangement will be changed.

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BOSTON—If it is true that a price of $20.50 a ton f.o.b. cars for cast scrap has been agreed upon in Washington, the way may be open for chiseling by shippers. Approximately 90 per cent of the cast scrap sold in New England is delivered by truck, and it will be by trucking charges that shippers will do their chiseling. Steel turnings are being produced in large quantities throughout New England and are rapidly shipped to consumers. Automobile scrap continues to come into the market slowly. A Woonsocket, R. I., scrap interest claims one wrecker in that state has the equivalent of 1000 cars of

British Scrap Drive Put on Firmer Basis

• • • The British last week moved to put iron and steel scrap collections on a firmer national basis, with the Ministry of Works taking full charge. Seizure powers are expected to be granted the Ministry, a step the national government long was hesitant to take because it involves overriding local governments.

Obsolete property of all descriptions will be commandeered, including bombed buildings which have not yet been torn down. About 250,000 tons of scrap have been recovered since last July from property damaged in bombing raids.

such scrap, and that there are large stocks elsewhere.

•

BUFFALO—Three more boats carrying about 15,000 tons from the Duluth area (probably the last lake shipments this year) were slated to dock here before the end of this week. This boosts to 85,000 tons the scrap unloaded in the last seven weeks. This week's receipts are reported going to the Bethlehem-Lackawanna plant. Local scrap sources are all but snowed under for the winter, dealers say.

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CINCINNATI—The foundry scrap condition in this area continues to tighten, but so far there have been no evidences of curtailment of output. OPM is being flooded with requests for allocations, but so far, these have not brought any results. Some feeling among foundrymen, that with the situation becoming daily more serious, they may be forced to share one another's inventory in an effort to keep operating.

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TORONTO—A survey of the scrap markets, supply and demand, reveals the fact that there will be a drastic shortage early in the coming year, and the question arises whether Canada will be able to maintain her present high rate of steel production. There is little hope that Canada will be able to increase her imports from the U. S. In recent months substantial enlargements have been made to electric furnaces and other large additions are underway or pending. As raw materials for these plants consist largely of scrap or pig iron, it now appears that Canada is building up some departments of her steel industry without giving due consideration to the supply of raw materials to maintain these plants.

•

CLEVELAND—Dealers have begun to worry about the probable decline in plant scrap that will be experienced in 1942, as production of certain consumer items is curtailed. This will mean less scrap available from automobile, refrigerator, washing machine, vacuum cleaner producers, and other consumer goods plants. Whether or not this will be made up by plant scrap resulting from the production of armaments is a question which has not been answered thus far. The outbreak of the war seems to have bestirred hoarders of small amounts of scrap who had previously been waiting higher prices before selling this material. Such small concerns, who are not scrap dealers or brokers in this area, are expected to yield increasingly large amounts of scrap during the next month or two. This "hoarded" material may slightly offset the usual winter drop in scrap collections. It is expected the adjustment of basing prices to eliminate inequities will aid the flow of scrap in those areas now being hurt by the present price differentials. Meanwhile, the amount of purchased scrap that will be available next year is being variously estimated at between 18,000,000 to 23,000,000 tons, as compared to the estimated 27,500,000 tons that will be consumed during 1941.

•

BIRMINGHAM—Although steel ingot production here was expectedly advanced this week, this advance does not reflect an improvement in scrap supplies. Unless there is a substantial increase in flow, a decline in ingot production from the present level immediately after the first of the year is considered inevitable.

Iron and Steel Scrap (other than railroad scrap)

(Maximum basing point prices as revised by OPA to Nov. 25, 1941, from which shipping point prices and consumers' delivered prices are to be computed, per gross ton)

Basing Points → / ▼ GRADES	Pittsburgh	Johnstown, Weirton, Steubenville, Youngstown, Warren, Sharon, Canton	Chicago	Kokomo	Bethlehem	Claymont, Coatesville, Phoenixville, Harrisburg, Conshohock'n	Sparrows Point	Buffalo	Cleveland	Toledo	Cincinnati* Portsmouth Middletown Ashland	St. Louis††	Detroit	Duluth Minneapolis**	Alabama City† Atlanta†† Birmingham	Chattanooga	Radford, Va	Worcester Bridgeport Phillipsdale, R. I.	Seattle	Los Angeles San F'nc'o*** Pittsb'g, Cal.	M'nneapolis, Colo. Portland, Ore.
No. 1 heavy melting	$20.00	$20.00	$18.75	$18.25	$18.25	$18.75	$18.75	$19.25	$19.50	.....	$19.50	$17.50	$17.85	$18.00	$17.00	.....	.....	.....	$14.50	$17.00	16.50
No. 1 hyd. comp. black sheet	20.00	20.00	18.75	18.25	18.25	18.75	18.75	19.25	19.50	.....	19.50	17.50	17.85	18.00	17.00	.....	.....	.....	14.50	17.00	16.50
No. 2 heavy melting	19.00	19.00	17.75	17.25	17.25	17.75	17.75	18.25	18.50	.....	18.50	16.50	16.85	17.00	16.00	.....	.....	(See	13.50	16.00	15.50
Dealers' No. 1 bundles	19.00	19.00	17.75	17.25	17.25	17.75	17.75	18.25	18.50	.....	18.50	16.50	16.85	17.00	16.00	.....	.....	foot-	13.50	16.00	15.50
Dealers' No. 2 bundles	18.00	18.00	16.75	16.25	16.25	16.75	16.75	17.25	17.50	.....	17.50	15.50	15.85	16.00	15.00	.....	.....	notes)	12.50	15.00	14.50
Mixed borings and turnings	15.25	15.25	14.00	14.25	13.50	14.00	14.00	14.50	14.75	13.10	14.75	12.75	13.10	.....	12.25	.....	.....	.....	9.75	12.25	11.75
Machine shop turnings	15.50	15.50	14.25	14.50	13.75	14.25	14.25	14.75	15.00	13.35	15.00	13.00	13.35	15.50	15.00	(Alloy, W.Va. ..... 17.60)	.....	.....	10.00	12.50	12.00
Shoveling turnings	16.50	16.50	15.25	15.50	14.75	15.25	15.25	15.75	16.00	14.35	16.00	14.00	14.35	16.50	16.00	.....	.....	.....	11.00	13.50	13.00
No. 1 busheling	19.50	19.50	18.25	17.75	17.75	18.25	18.25	18.75	19.00	.....	19.00	17.00	17.35	17.50	16.50	.....	.....	.....	14.00	16.50	16.00
No. 2 busheling	15.50	15.50	14.25	13.75	13.75	14.25	14.25	14.75	15.00	.....	15.00	13.00	13.35	13.50	12.50	.....	.....	.....	10.00	12.50	12.00
Cast iron borings	15.75	15.75	14.50	14.00	14.00	14.50	14.50	15.00	15.25	13.60	*15.25	13.25	13.60	13.75	12.75	.....	.....	.....	10.25	12.75	12.25
Uncut structural, plate scrap	19.00	19.00	17.75	17.25	17.25	17.75	17.75	18.25	18.50	.....	18.50	16.50	16.85	17.00	16.00	.....	.....	.....	13.50	16.00	15.50
No. 1 cupola	21.00	21.00	20.00	20.00	22.50	23.00	22.00	20.00	22.00	.....	21.00	20.00	20.35	19.00	20.00	20.50	21.00	22.00	18.00	19.50	18.00
Heavy breakable cast	19.50	19.50	18.50	18.50	21.00	21.50	21.00	18.50	20.50	.....	19.50	18.50	18.85	17.50	18.50	19.00	19.50	20.50	17.00	18.00	16.50
Stove plate	19.00	[5]19.00	17.00	16.00	18.00	18.50	18.00	19.00	18.00	15.60	17.50	17.00	14.10	16.00	17.00	17.50	18.00	17.50	14.00	16.50	15.00
Low phos. billet, bloom crops	25.00	25.00	23.75	23.75	23.25	23.75	23.75	24.25	24.50	.....	24.50	22.50	22.85	23.00	22.00	.....	.....	.....	19.50	22.00	20.50
Low phos. bar crops, smaller	23.00	23.00	21.75	21.75	21.25	21.75	21.75	22.25	22.50	.....	22.50	20.50	20.85	21.00	20.00	.....	.....	.....	19.50	20.00	18.50
Low phos. pu'ch'gs, plate scrap[1]	24.75	23.00	21.75	21.75	21.25	21.75	21.75	22.25	22.50	.....	22.50	20.50	20.85	21.00	20.00	.....	.....	.....	17.50	20.00	18.50
Machinery cast, cupola size[2]	22.00	22.00	21.00	21.00	23.50	24.00	23.50	21.00	23.00	.....	22.00	21.00	21.35	20.00	21.00	21.50	22.00	23.00	19.00	20.50	19.00
No. 1 mach. cast, drop-broken, 150 lb. and under	22.50	22.50	21.50	21.50	24.00	24.50	24.00	21.50	23.50	.....	22.50	21.50	21.85	20.50	21.50	22.00	22.50	23.50	19.50	21.00	19.50
Clean auto cast	22.50	22.50	21.50	21.50	24.00	24.50	24.00	21.50	23.50	.....	22.50	21.50	21.85	20.50	21.50	22.00	22.50	23.50	19.50	21.00	19.50
Punchings and plate scrap[3]	23.75	22.00	20.75	20.75	20.25	20.75	20.75	21.25	21.50	.....	21.50	19.50	19.85	20.00	19.00	.....	.....	.....	16.50	19.00	17.50
Punchings and plate scrap[4]	22.75	21.00	19.75	19.75	19.25	19.75	19.75	20.25	20.50	.....	20.50	18.50	18.85	19.00	18.00	.....	.....	.....	15.50	18.00	16.50
Heavy axle, forge turnings	21.25	19.50	18.25	18.25	17.75	18.25	18.25	18.75	19.00	.....	19.00	17.00	17.35	17.50	16.50	.....	.....	.....	14.00	16.50	15.00
Medium h'vy el f'ce turnings	19.75	18.00	16.75	16.75	16.25	16.75	16.75	17.25	17.50	.....	17.50	15.50	15.85	16.00	15.00	.....	.....	.....	12.50	15.00	13.50

[1] This grade is ⅜-in. and heavier, cut 12 in. and under. [2] May include clean agricultural cast. [3] Under ⅜ to ¼-in., cut 12 in. and under. [4] Under ¼-in. to No. 12 gage, cut 12 in. and under. [5] Youngstown, Warren, Sharon and Canton are not basing points on this grade. * Middletown and Cincinnati price for this grade is $15. * Includes Newport, Ky. Shipping point price within Cincinnati basing point may be 80c. a ton below basing point price listed above for all grades except the six cast grades. ** Minneapolis and St. Paul are basing points on following grades only: No. 1 cupola, heavy breakable cast, stove plate, machinery cast cupola size, No. 1 machinery cast drop broken, clean auto cast. † Alabama City, Ala., is basing point only on No. 1 heavy melting; No. 1 compressed black sheets; No. 2 heavy melting; dealers' No. 1 and No. 2 bundles, mixed borings and turnings; machine shop turnings; shoveling turnings; No. 1 and No. 2 busheling; cast iron borings; uncut structural and plate scrap. †† Atlanta is basing point only on No. 1 and No. 2 heavy melting; No. 1 compressed black sheets; No. 1 and No. 2 dealers' bundles. ††† St. Louis basing point includes the switching district of Granite City, East St. Louis, and Madison, Ill. *** The San Francisco basing point includes the switching districts of South San Francisco, Niles and Oakland.

Railroad Scrap *(Per gross ton, delivered consumers' plants located on line of railroad originating scrap)*

Basing Points → / ▼ GRADES	Pittsburgh Sharon, Pa. Wheeling Steubenville Youngstown Canton	Chicago	Kokomo	Philadelphia	Wilmington	Sparrows Point	Cleveland	Buffalo	Portsmouth Middletown Ashland	St. Louis	Kansas City	Cincinnati	Detroit	Duluth	Birmingham	Seattle	Los Angeles San Francisco
No. 1 heavy melting	$21.00	$19.75	$19.25	$19.75	$19.75	$19.75	$20.50	$20.25	$20.50	$18.50	$17.00	$20.50	$18.85	$19.00	$18.00	$15.50	18.00
Scrap rails	22.00	20.75	20.25	20.75	20.75	20.75	21.50	21.25	21.50	19.50	18.00	21.50	19.85	20.00	19.00	16.50	19.00
Rerolling rails	23.50	22.25	21.75	22.25	22.25	22.25	23.00	22.75	23.00	21.00	19.50	23.00	21.35	21.50	20.50	18.00	20.50
Scrap rails 3 ft. and under	24.00	22.75	22.25	22.75	22.75	22.75	23.50	23.25	23.50	21.50	20.00	23.50	21.85	22.00	21.00	18.50	21.00
Scrap rails 2 ft. and under	24.25	23.00	22.50	23.00	23.00	23.00	23.75	23.50	23.75	21.75	20.25	27.75	22.10	22.25	21.25	18.75	21.25
Scrap rails 18 in. and under	24.50	23.25	22.75	23.25	23.25	23.25	24.00	23.75	24.00	22.00	20.50	24.00	22.35	22.50	21.50	19.00	21.50

Railroads not operating in a basing point may sell rerolling rails f.o.b. their lines at average price of their sales from Sept. 1, 1940, to Jan. 31, 1941. Rerolling mills may absorb all transportation charges necessary to obtain such rails. Maximum prices for scrap rails and rerolling rails from mines, logging camps and similar sources need not be sold for less than $13.50 a gross ton for scrap rails and $15 for rerolling material at shipping point.

Where the railroad originator of the scrap operates in two or more of the basing points named, the highest of the maximum prices established for such basing points shall be the maximum price of the scrap delivered to a consumer's plant at any point on the railroad's line, except that switching charges of 84c. per gross ton shall be subtracted from the maximum prices of scrap originating from railroads operating in Chicago and sold for consumption outside Chicago.

Explanatory Notes

(A basing point includes its switching district)

MAXIMUM PRICE at which any grade of scrap may be delivered to consumer's plant, wherever located, is the shipping point price, plus actual transportation from the shipping point to consumer. Where shipment is by water, actual handling charges at the dock of not more than 75c. a gross ton may be included as part of transportation charges. In no case may this maximum price exceed by more than $1 prices (for material other than railroad scrap) for the basing point nearest the consumer.

COMPUTING SHIPPING POINT PRICE: A shipping point is the point from which the scrap is to be shipped to a consumer. A shipping point price is computed as follows: (a) For Shipping Points located within a basing point.—The price established for the basing point in which the shipping point is located, is determined. Then deduct from this the actual costs involved in transporting scrap from the shipping point to the consumer's plant within the basing point which is nearest, in terms of transportation costs, to the shipping point; (b) For shipping points located outside a basing point.—The price established for the nearest basing point, in terms of transportation charges, to the shipping point is determined. Deduct from this the lowest established charge for transporting scrap from the shipping point to such basing point. *Exceptions:* (1) The shipping point price at any shipping point in New England, of those grades of scrap for which no prices are listed above shall be the Johnstown basing point price, minus the all-rail transportation costs from the New England shipping point to Johnstown; (2) Shipping point prices for New York City, Brooklyn, New York, and New Jersey shall be computed from the Bethtlehem, Pa., basing point.

GULF PORT PRICES: Scrap shipped from Tampa, Pensacola, Gulfport, Mobile, New Orleans, Lake Charles, Port Arthur, Beaumont, Galveston, Texas City, Houston and Corpus Christi, has a maximum shipping point price not exceeding $14 a gross ton, f.o.b. cars, for No. 1 heavy melting steel. For other grades, the differentials established for Birmingham apply.

REMOTE SCRAP: Defined as all grades of scrap listed in table above (exclusive of railroad scrap) located in Florida, Montana, Idaho, Wyoming, Nevada, Arizona, New Mexico, Texas and Oklahoma. Maximum shipping point price of remote scrap is $12 a gross ton, for No. 2 heavy melting steel, with differentials for other grades the same as differentials established in table above for St. Louis. The maximum delivered price of remote scrap is the shipping point price, plus actual transportation charges, except that when necessary to absorb transportation charges, the maximum delivered price may be exceeded by a maximum of $4 a ton. Thus the maximum delivered price for remote scrap may exceed the price for the nearest basing point by $5. In the event that an allowance in excess of $5 a ton is necessary to acquire a tonnage of remote scrap, a consumer may apply to OPA for permission to exceed the $5 allowance. Purchases under these remote scrap provisions must be for not less than one car a month and must be reported in detail. Provisions of this remote scrap section expire Dec. 31, 1941.

BROKER COMMISSIONS: A commission of up to 50c. a ton above the maximum prices is allowed to brokers.

*OPA maximum for sale by dealer. **Nominal.

UNPREPARED SCRAP: Regardless of source, maximum price of unprepared scrap is $2.50 less than maximum for corresponding grade of prepared scrap.

BILLET AND BLOOM CROPS: Where such material originates in the Pittsburgh basing point, it may be sold delivered to a consumer within or without the Pittsburgh point at the price given in Schedule 'A, plus not more than $2.50 in transportation charges. Lowest established transportation charges will govern.

Non-Ferrous Scrap

(Dealers buying prices, cents per lb.)

	New York	Philadelphia	Pittsburgh	Cleveland	Detroit	Chicago
No. 1 hvy. copper	*10.00	*10.00	*10.00	*10.00	*10.00	*10.00
Light copper	* 8.00	* 8.00	* 8.00	* 8.00	* 8.00	* 8.00
Hvy. yel. brass	6.25-6.50	**6.25	7.50-8.00	5.75-6.25	7.00-7.25	7.50
Light brass	5.25-5.50	**5.50	7.00-7.25	6.00-6.50	6.50-6.75	7.00-7.25
No. 1 Comp. turn.	8.75-9.00	**7.75	**9.00-9.25	8.50-9.00	9.00-9.25	9.00-9.25
New brass clips	8.00-8.25	8.50-9.00	7.75-8.00	8.00-8.50	7.50-8.00	7.75-8.25
Soft lead	5.25-5.50	5.00-5.25	4.75-5.00	4.75-5.00	5.00-5.25	4.75-5.00
Old zinc	4.00-4.25	4.25	4.25-4.50	4.00-4.50	4.25-4.50	4.50-5.00
Cast, forged alum.	*11.00	*11.00	*11.00	*11.00	*11.00	*11.00
Old sheet alum.	*11.00	*11.00	*11.00	*11.00	*11.00	*11.00
Solder joints	8.75-9.00	9.00	7.50-8.00	6.50-6.75	5.50-6.00	7.50-8.00
No. 1 pewter	35.00-36.00	35.00-36.00	31.00-32.00	32.50-34.00	37.50-38.50	32.80-34.00

* OPA maximum for sale by dealer. ** Nominal.

. . . Comparison of Prices

(Advances Over Past Week in **Heavy Type**; Declines in *Italics*)

(Prices Are F.O.B. Major Basing Points)

Flat Rolled Steel:
(Cents Per Lb.)

	Dec. 15, 1941	Dec. 9, 1941	Nov. 18, 1941	Dec. 16, 1940
Hot rolled sheets	2.10	2.10	2.10	2.10
Cold rolled sheets	3.05	3.05	3.05	3.05
Galvanized sheets (24 ga.)	3.50	3.50	3.50	3.50
Hot rolled strip	2.10	2.10	2.10	2.10
Cold rolled strip	2.80	2.80	2.80	2.80
Plates	2.10	2.10	2.10	2.10
Stain's c.r. strip (No. 302)	28.00	28.00	28.00	28.00

Tin and Terne Plate:
(Dollars Per Base Box)

Tin plate	$5.00	$5.00	$5.00	$5.00
Manufacturing ternes	4.30	4.30	4.30	4.30

Bars and Shapes:
(Cents Per Lb.)

Merchant bars	2.15	2.15	2.15	2.15
Cold finished bars	2.65	2.65	2.65	2.65
Alloy bars	2.70	2.70	2.70	2.70
Structural shapes	2.10	2.10	2.10	2.10
Stainless bars (No. 302)	24.00	24.00	24.00	24.00

Wire and Wire Products:
(Cents Per Lb.)

Plain wire	2.60	2.60	2.60	2.60
Wire nails	2.55	2.55	2.55	2.55

Rails:
(Dollars Per Gross Ton)

Heavy rails	$40.00	$40.00	$40.00	$40.00
Light rails	40.00	40.00	40.00	40.00

Semi-Finished Steel:
(Dollars Per Gross Ton)

Rerolling billets	$34.00	$34.00	$34.00	$34.00
Sheet bars	34.00	34.00	34.00	34.00
Slabs	34.00	34.00	34.00	34.00
Forging billets	40.00	40.00	40.00	40.00
Alloy blooms, billets, slabs	54.00	54.00	54.00	54.00

Wire Rods and Skelp:
(Cents Per Lb.)

Wire rods	2.00	2.00	2.00	2.00
Skelp (grvd)	1.90	1.90	1.90	1.90

Pig Iron:
(Per Gross Ton)

	Dec. 15, 1941	Dec. 9, 1941	Nov. 18, 1941	Dec. 16, 1940
No. 2 fdy., Philadelphia	$25.84	$25.84	$25.84	$24.84
No. 2, Valley furnace	24.00	24.00	24.00	23.00
No. 2, Southern Cin'ti	24.06	24.06	24.06	23.06
No. 2, Birmingham	20.38	20.38	20.38	19.38
No. 2, foundry, Chicago†	24.00	24.00	24.00	23.00
Basic, del'd eastern Pa.	25.34	25.34	25.34	24.34
Basic, Valley furnace	23.50	23.50	23.50	22.50
Malleable, Chicago†	24.00	24.00	24.00	23.00
Malleable, Valley	24.00	24.00	24.00	23.00
L. S. charcoal, Chicago	31.34	31.34	31.34	30.34
Ferromanganese‡	120.00	120.00	120.00	120.00

†The switching charge for delivery to foundries in the Chicago district is 50c. per ton. ‡For carlots at seaboard.

Scrap:
(Per Gross Ton)

Heavy melt'g steel, P'gh.	$20.00	$20.00	$20.00	$22.75
Heavy melt'g steel, Phila.	18.75	18.75	18.75	20.75
Heavy melt'g steel, Ch'go	18.75	18.75	18.75	20.50
No. 1 hy. com. sheets, Det.	17.85	17.85	17.85	19.00
Low phos. plate, Youngs'n	23.00	23.00	23.00	26.00
No. 1 cast, Pittsburgh	22.00	22.00	22.00	22.75
No. 1 cast, Philadelphia	24.00	24.00	24.00	23.25
No. 1 cast, Chicago*	21.00	21.00	21.00	19.25

*Changed to gross ton basis, April 3, 1941.

Coke, Connellsville:
(Per Net Ton at Oven)

Furnace coke, prompt	$6.125	$6.125	$6.125	$5.50
Foundry coke, prompt	6.875	6.875	6.875	5.75

Non-Ferrous Metals:
(Cents per Lb. to Large Buyers)

Copper, electro., Conn.*	12.00	12.00	12.00	12.00
Copper, Lake, New York	12.00	12.00	12.00	12.00
Tin (Straits), New York	52.00	52.00	52.00	50.05
Zinc, East St. Louis	8.25	8.25	8.25	7.25
Lead, St. Louis	5.70	5.70	5.70	5.35
Antimony (Asiatic), N. Y.	16.50	16.50	16.50	16.50

*Mine producers only.

The various basing points for finished and semi-finished steel are listed in detailed price tables, pages 132-138.
On export business there are frequent variations from the above prices. Also in domestic business, there is at times a range of prices on various products, as shown in our detailed price tables.

. . . Composite Prices

	PIG IRON	SCRAP STEEL
Dec. 15, 1941	2.30467c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
Nov. 25, 1941	2.30467c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One week ago	2.30467c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One month ago	2.30467c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One year ago	2.30467c. a Lb.	$22.61 a Gross Ton	$21.33 a Gross Ton

	High	Low
1941	2.30467c.,	2.30467c.,
1940	2.30467c., Jan. 2	2.24107c., Apr. 16
1939	2.35367c., Jan. 3	2.26689c., May 16
1938	2.58414c., Jan. 4	2.27207c., Oct. 18
1937	2.58414c., Mar. 9	2.32263c., Jan. 4
1936	2.32263c., Dec. 28	2.05200c., Mar. 10
1935	2.07642c., Oct. 1	2.06492c., Jan. 8
1934	2.15367c., Apr. 24	1.95757c., Jan. 2
1933	1.95578c., Oct. 3	1.75836c., May 2
1932	1.89196c., July 5	1.83901c., Mar. 1
1931	1.99629c., Jan. 13	1.86586c., Dec. 29
1930	2.25488c., Jan. 7	1.97319c., Dec. 9
1929	2.31773c., May 28	2.26498c., Oct. 29

A weighted index based on steel bars, beams, tank plates, wire, rails, black pipe, hot and cold-rolled sheets and strip. These products represent 78 per cent of the United States output. This revised index recapitulated to 1929 in the Aug. 28, 1941, issue.

	High	Low
1941	$23.61, Mar. 20	$23.45, Jan. 2
1940	23.45, Dec. 23	22.61, Jan. 2
1939	22.61, Sept. 19	20.61, Sept. 12
1938	23.25, June 21	19.61, July 6
1937	23.25, Mar. 9	20.25, Feb. 16
1936	19.74, Nov. 24	18.73, Aug. 11
1935	18.84, Nov. 5	17.83, May 14
1934	17.90, May 1	16.90, Jan. 27
1933	16.90, Dec. 5	13.56, Jan. 3
1932	14.81, Jan. 5	13.56, Dec. 6
1931	15.90, Jan. 6	14.79, Dec. 15
1930	18.21, Jan. 7	15.90, Dec. 16
1929	18.71, May 14	18.21, Dec. 17

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

	High	Low
1941	$22.00, Jan. 7	$19.17, Apr. 10
1940	21.83, Dec. 30	16.04, Apr. 9
1939	22.50, Oct. 3	14.08, May 16
1938	15.00, Nov. 22	11.00, June 7
1937	21.92, Mar. 30	12.92, Nov. 10
1936	17.75, Dec. 21	12.67, June 9
1935	13.42, Dec. 10	10.33, Apr. 29
1934	13.00, Mar. 13	9.50, Sept. 25
1933	12.25, Aug. 8	6.75, Jan. 3
1932	8.50, Jan. 12	6.43, July 5
1931	11.33, Jan. 6	8.50, Dec. 29
1930	15.00, Feb. 18	11.25, Dec. 9
1929	17.58, Jan. 29	14.08, Dec. 3

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

Prices of Finished Iron and Steel...

Steel prices shown here are f.o.b. basing points, in cents per lb., unless otherwise indicated. On some products either quantity deductions or quantity extras apply. In many cases gage, width, cutting, physical, chemical extras, etc., apply to the base price. Actual realized prices to the mill, therefore, are affected by extras, deductions, and in most cases freight absorbed to meet competition.

Basing Point → / Product ↓	Pittsburgh	Chicago	Gary	Cleveland	Birmingham	Buffalo	Youngstown	Sparrows Point	Granite City	Middletown, Ohio	Gulf Ports, Cars	Pacific Ports, Cars	DELIVERED TO Detroit	New York	Philadelphia
SHEETS															
Hot rolled	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.20¢	2.10¢		2.65¢	2.20¢	2.34¢	2.27¢
Cold rolled[1]	3.05¢	3.05¢	3.05¢	3.05¢		3.05¢	3.05¢		3.15¢	3.05¢		3.70¢	3.15¢	3.39¢	3.37¢
Galvanized (24 ga.)	3.50¢	3.50¢	3.50¢		3.50¢	3.50¢	3.50¢	3.50¢	3.60¢	3.50¢		4.05¢		3.74¢	3.67¢
Enameling (20 ga.)	3.35¢	3.35¢	3.35¢	3.35¢			3.35¢		3.45¢	3.35¢		4.00¢	3.45¢	3.71¢	3.67¢
Long ternes[2]	3.80¢		3.80¢									4.55¢			
STRIP															
Hot rolled[3]	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢			2.10¢		2.75¢	2.20¢	2.46¢	
Cold rolled[4]	2.80¢	2.90¢		2.80¢			2.80¢	(Worcester = 3.00¢)					2.90¢	3.16¢	
Cooperage stock	2.20¢	2.20¢			2.20¢		2.20¢							2.56¢	
Commodity C-R	2.95¢			2.95¢			2.95¢	(Worcester = 3.35¢)					3.05¢	3.31¢	
TIN PLATE															
Standard cokes, base box	$5.00	$5.00	$5.00						$5.10						$5.32
BLACK PLATE															
29 gage[5]	3.05¢	3.05¢	3.05¢						3.15¢			4.05¢ (10)			3.37¢
TERNES M'FG.															
Special coated, base box	$4.30	$4.30	$4.30						$4.40						
BARS															
Carbon steel	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢		(Duluth = 2.25¢)			2.50¢	2.80¢	2.25¢	2.49¢	2.47¢
Rail steel[6]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢					2.50¢	2.80¢			
Reinforcing (billet)[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢			2.50¢	2.55¢	2.25¢	2.39¢	
Reinforcing (rail)[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢				2.50¢	2.55¢	2.25¢		2.47¢
Cold finished[8]	2.65¢	2.65¢	2.65¢	2.65¢		2.65¢			(Detroit = 2.70¢)					3.01¢	2.97¢
Alloy, hot rolled	2.70¢	2.70¢				2.70¢		(Bethlehem, Massillon, Canton = 2.70¢					2.80¢		
Alloy, cold drawn	3.35¢	3.35¢	3.35¢	3.35¢		3.35¢							3.45¢		
PLATES								(Coatesville and Claymont = 2.10¢)							
Carbon steel	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢	2.25¢(11)		2.45¢	2.65¢	2.25¢	2.29¢	2.15¢
Wrought iron	3.80¢														
Floor plates	3.35¢	3.35¢									3.70¢	4.00¢		3.71¢	3.67¢
Alloy	3.50¢	3.50¢			(Coatesville = 3.50¢)						3.95¢	4.15¢		3.70¢	3.37¢
SHAPES															
Structural	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢		(Bethlehem = 2.10¢)			2.45¢	2.75¢		2.27¢	2.215¢
SPRING STEEL C-R															
0.26 to 0.50 Carbon	2.80¢			2.80¢			(Worcester = 3.00¢)								
0.51 to 0.75 Carbon	4.30¢			4.30¢			(Worcester = 4.50¢)								
0.76 to 1.00 Carbon	6.15¢			6.15¢			(Worcester = 6.35¢)								
1.01 to 1.25 Carbon	8.35¢			8.35¢			(Worcester = 8.55¢)								
WIRE[9]															
Bright	2.60¢	2.60¢		2.60¢	2.60¢		(Worcester = 2.70¢)					3.10¢			2.92¢
Galvanized	2.60¢	2.60¢		2.60¢	2.60¢		(Worcester = 2.70¢)					3.10¢			2.92¢
Spring	3.20¢	3.20¢		3.20¢			(Worcester = 3.30¢)					3.80¢			3.52¢
PILING															
Steel sheet	2.40¢	2.40¢				2.40¢						2.95¢			2.72¢
IRON BARS															
Common		2.25¢			(Terre Haute, Ind. = 2.15¢)										
Wrought single refined	4.40¢														
Wrought double refined	5.40¢														

[1] Mill run sheets are 10c. per 100 lb. less than base; and primes only, 25c. above base. [2] Unassorted 8-lb. coating. [3] Widths up to 12 in. [4] Carbon 0.25 per cent and less. [5] Applies to certain width and length limitations. [6] For merchant trade. [7] Straight lengths as quoted by distributers. [8] Also shafting. For quantities of 20,000 to 39,999 lb. [9] Carload lot to manufacturing trade. [10] Boxed. [11] Ship plates only.

SEMI-FINISHED STEEL

Billets, Blooms and Slabs

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point (rerolling only). Prices delivered Detroit are $2 higher; f.o.b. Duluth, billets only, $2 higher.

	Per Gross Ton
Rerolling	$34.00
Forging quality	40.00

Shell Steel

Basic open hearth shell steel, f.o.b. Pittsburgh and Chicago.

	Per Gross Ton
3 in. to 12 in.	$52.00
12 in. to 18 in.	54.00
18 in. and over	56.00

Note: The above base prices apply on lots of 1000 tons of a size and section to which are to be added extras for chemical requirements, cutting to length, or quantity.

Sheet Bars

Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

	Per Gross Ton
Open hearth or bessemer	$34.00

Skelp

Pittsburgh, Chicago, Youngstown, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved, universal and sheared	1.90c.

Wire Rods

(No. 5 to 9/32 in.)	*Per Lb.*
Pittsburgh, Chicago, Cleveland.	2.00c.
Worcester, Mass.	2.10c.
Birmingham	2.00c.
San Francisco	2.50c.
Galveston	2.25c.

9/32 in. to 47/64 in., 0.15c. a lb. higher. Quantity extras apply.

Alloy Steel Blooms, Billets and Slabs

	Per Gross Ton
Pittsburgh, Chicago, Canton, Massillon, Buffalo or Bethlehem	$54.00

TOOL STEEL

(F.o.b. Pittsburgh)

	Base per Lb.
High speed	67c.
High-carbon-chromium	43c.
Oil hardening	24c.
Special carbon	22c.
Extra carbon	18c.
Regular carbon	14c.

Prices for warehouse distribution to all points on or East of Mississippi River are 2c. a lb. higher. West of Mississippi quotations are 3c. a lb. higher.

PIG IRON

All prices set in **bold face type** are maxima established by OPA on June 24, 1941. Other domestic prices are delivered quotations per gross ton computed on the basis of the official maxima.

	No. 2 Foundry	Basic	Bessemer	Malleable	Low Phosphorous	Charcoal
Boston	$25.50	$25.00	$26.50	$26.00	.....	.....
Brooklyn	27.50	.....	.....	28.00	.....	.....
Jersey City	26.53	26.03	27.53	27.03	.....	.....
Philadelphia	25.84	25.34	26.84	26.34	.....	.....
Bethlehem, Pa.	**$25.00**	**$24.50**	**$26.00**	**$25.50**	.....	.....
Everett, Mass.	**25.00**	**24.50**	**26.00**	**25.50**	.....	.....
Swedeland, Pa.	**25.00**	**24.50**	**26.00**	**25.50**	.....	.....
Steelton, Pa.	.....	**24.50**	.....	.....	**$29.50**	.....
Birdsboro, Pa.	**25.00**	**24.50**	**26.00**	**25.50**	**29.50**	.....
Sparrows Point, Md.	**25.00**	**24.50**	.....	.....	.....	.....
Erie, Pa.	**24.00**	**23.50**	**25.00**	**24.50**	.....	.....
Neville Island, Pa.	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Sharpsville, Pa.*	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Buffalo	**24.00**	**23.00**	**25.00**	**24.50**	**29.50**	.....
Cincinnati	24.44	24.61	.....	25.11	.....	.....
Canton, Ohio	25.39	24.89	25.89	25.39	.....	.....
Mansfield, Ohio	25.94	25.44	26.44	25.94	.....	.....
St. Louis	24.50	24.02	.....	.....	.....	.....
Chicago	**24.00**	**23.50**	**24.50**	**24.00**	.....	....$31.34
Granite City, Ill.	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Cleveland	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Hamilton, Ohio	**24.00**	**23.50**	.....	**24.00**	.....	.....
Toledo	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Youngstown*	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Detroit	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Lake Superior fc.	.....	.....	.....	.....	.....	**$28.00**
Lyles, Tenn. fc.†	.....	.....	.....	.....	.....	**33.00**
St. Paul	26.63	.....	27.13	26.63	.....	.....
Duluth	**24.50**	.....	**25.00**	**24.50**	.....	.....
Birmingham	**20.38**	**19.00**	**25.00**	.....	.....	.....
Los Angeles	27.50	.....	.....	.....	.....	.....
San Francisco	27.50	.....	.....	.....	.....	.....
Seattle	27.50	.....	.....	.....	.....	.....
Provo, Utah	**22.00**	.....	.....	.....	.....	.....
Montreal	27.50	27.50	.....	28.00	.....	.....
Toronto	25.50	25.50	.....	26.00	.....	.....

GRAY FORGE IRON

Valley or Pittsburgh furnace..... **$23.50**

*Pittsburgh Coke & Iron Co. (Sharpsville, Pa., furnace only) and the Struthers Iron and Steel Co., Struthers, Ohio, may charge 50c. a ton in excess of basing point prices for No. 2 foundry, basic, bessemer and malleable.

Switching Charges: Basing point prices are subject to an additional charge for delivery within the switching limits of the respective districts.

Silicon Differentials: Basing point prices are subject to an additional charge not to exceed 50c. a ton for each 0.25 per cent silicon content in excess of basic grade (1.75 per cent to 2.25 per cent).

Phosphorous Differential: Basing point prices are subject to a reduction of 38c. per ton for phosphorous content of 0.70 per cent and over.

†Price shown is for low-phosphorous iron; high-phosphorous sells for $28.50 at the furnace.

Manganese Differentials: Basing point prices are subject to an additional charge not to exceed 50c. a ton for each 0.50 per cent manganese content in excess of 1.00 per cent.

WAREHOUSE PRICES

	Pittsburgh	Chicago	Cleveland	Philadelphia	New York	Detroit	Buffalo	Boston	Birmingham	St. Louis	St. Paul	Milwaukee	Los Angeles
Sheets, hot rolled	$3.35	$3.25	$3.35	$3.75	$3.58	$3.43	$3.25	$3.71	$3.45	$3.39	$3.30	$3.38	$5.10
Sheets, cold rolled	....	4.10	4.05	4.05	4.60	4.30	4.30	3.68	....	4.24	4.35	4.23	7.30
Sheets, galvanized	4.65	4.85	4.75	5.00	5.00	4.84	4.75	5.11	4.75	4.99	4.75	4.98	6.30
Strip, hot rolled	3.60	3.60	3.50	3.95	3.96	3.68	3.82	4.06	3.70	3.74	3.65	3.73	....
Strip, cold rolled	3.20	3.50	3.20	3.31	3.51	3.40	3.52	3.46	....	3.61	3.83	3.54	....
Plates	3.40	3.55	3.40	3.75	3.76	3.60	3.62	3.85	3.55	3.69	3.80	3.68	4.95
Structural shapes	3.40	3.55	3.58	3.75	3.75	3.65	3.40	3.85	3.55	3.69	3.80	3.68	4.95
Bars, hot rolled	3.35	3.50	3.25	3.85	3.84	3.43	3.35	3.98	3.50	3.64	3.75	3.63	**4.15
Bars, cold finished	3.65	3.75	3.75	4.06	4.09	3.80	3.75	4.13	4.43	4.02	4.34	3.88	6.60
Bars, ht. rld. SAE 2300	7.45	7.35	7.55	7.31	7.60	7.67	7.35	7.50	....	7.72	7.45	7.58	10.35
Bars, ht. rld. SAE 3100	5.75	5.65	5.85	5.86	5.90	5.97	5.65	6.05	....	6.02	6.00	5.88	9.35
Bars, cd. drn. SAE 2300	8.40	8.40	8.40	8.56	8.84	8.70	8.40	8.63	....	8.77	8.84	8.63	11.35
Bars, cd. drn. SAE 3100	6.75	6.75	7.75	7.16	7.19	7.05	6.75	7.23	....	7.12	7.44	6.98	10.35

BASE QUANTITIES: Hot rolled sheets, cold rolled sheets, hot rolled strip, plates, shapes and hot rolled bars, 400 to 1999 lb., galvanized sheets, 150 to 1499 lb.; cold rolled strip, extras apply on all quantities; cold finished bars, 1500 lb. and over; SAE bars, 1000 lb. and over. Exceptions; Chicago, galvanized sheets, 500 to 1499 lb.; Philadelphia, galvanized sheets, one to nine bundles, cold rolled sheets, 1000 to 1999 lb.; Detroit, galvanized sheets, 500 to 1499 lb.; Buffalo, cold rolled sheets, 500 to 1500 lb., galvanized sheets, 450 to 1499 lb., cold rolled strips, 0.0971 in. thick; Boston, cold rolled and galvanized sheets, 450 to 3749 lb.; Birmingham, hot rolled sheets, strip and bars, plates and shapes, 400 to 3999 lb., galvanized sheets, 500 to 1499 lb.; St. Louis, cold rolled sheets, 400 to 1499 lb., galvanized sheets, 500 to 1499 lb., cold rolled strip 0.095 in. and lighter; Milwaukee, cold rolled sheets, 400 to 1499 lb., galvanized sheets, 500 to 1499 lb., New York, hot rolled sheets, 0 to 1999 lb., cold rolled sheets, 400 to 1499 lb.; St. Paul, galvanized and cold rolled sheets, any quantity, hot rolled bars, plates, shapes, hot rolled sheets, 400 to 14,999 lb.; Los Angeles, cold rolled sheets, 300 to 1999 lb., galvanized sheets, 24 ga.—1 to 1499 lb. Extras for size, quality, etc., apply on above quotations. *12 gage and heavier, $3.43. **Over 4 in. wide and over 1 in. thick, $4.95.

CORROSION AND HEAT-RESISTING STEELS

(Per lb. base price, f.o.b. Pittsburgh)

Chromium-Nickel Alloys

	No. 304	No. 302
Forging billets	21.25c.	20.40c.
Bars	25.00c.	24.00c.
Plates	29.00c.	27.00c.
Structural shapes	25.00c.	24.00c.
Sheets	36.00c.	34.00c.
Hot rolled strip	23.50c.	21.50c.
Cold rolled strip	30.00c.	28.00c.
Drawn wire	25.00c.	24.00c.

Straight-Chromium Alloys

	No. 410	No. 430	No. 442	No. 446
F.Billets	15.73c.	16.15c.	19.13c.	23.38c.
Bars	18.50c.	19.00c.	22.50c.	27.50c.
Plates	21.50c.	22.00c.	25.50c.	30.50c.
Sheets	26.50c.	29.00c.	32.50c.	36.50c.
Hotstrip	17.00c.	17.50c.	24.00c.	25.00c.
Cold st.	22.00c.	22.50c.	32.00c.	52.00c.

Chromium-Nickel Clad Steel (20%)

	No. 304
Plates	18.00c.*
Sheets	19.00c.

*Includes annealing and pickling.

ELECTRICAL SHEETS

(Base, f.o.b. Pittsburgh)

	Per Lb.
Field grade	3.20c.
Armature	3.55c.
Electrical	4.05c.
*Motor	4.95c.
*Dynamo	5.65c.
Transformer 72	6.15c.
Transformer 65	7.15c.
Transformer 58	7.65c.
Transformer 52	8.45c.

Silicon strip in coils—Sheet price plus silicon sheet extra width extra plus 25c. per 100 lb. for coils. Pacific ports add 75c. per 100 lb.

*In some instances motor grade is referred to as dynamo grade and dynamo grade is referred to as dynamo special.

ROOFING TERNE PLATE

(F.o.b. Pittsburgh, per Package of 112 Sheets)

	20x14 in.	20x28 in.
8-lb. coating I.C.	$6.00	$12.00
15-lb. coating I.C.	7.00	14.00
20-lb. coating I.C.	7.50	15.00
25-lb. coating I.C.	8.00	16.00
30-lb. coating I.C.	8.63	17.25
40-lb. coating I.C.	9.75	19.50

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

Per Cent Off List

Machine and Carriage Bolts:

6½ in., shorter and smaller	65½
6 x ⅝ in., and shorter	63½
6 in. by ¾ to 1 in. and shorter	61
1⅛ in. and larger, all length	59
All diameters over 6 in. long	59
Lag, all sizes	62
Plow bolts	65

Nuts, Cold Punched or Hot Pressed:

(hexagon or square)

½ in. and smaller	62
9/16 to 1 in. inclusive	59
1⅛ to 1½ in. inclusive	57
1⅝ in. and larger	56

On above bolts and nuts, excepting plow bolts, additional allowance of 10 per cent for full container quantities. There is an additional 5 per cent allowance for carload shipments.

Semi-Fin. Hexagon Nuts	U.S.S.	S.A.E.
7/16 in. and smaller	..	64
½ in. and smaller	62	..
½ in. through 1 in.	..	60
9/16 to 1 in.	59	..
1⅛ in. through 1½ in.	57	58
1⅝ in. and larger	56	

In full container lots, 10 per cent additional discount.

Stove bolts, packages, nuts loose 71 and 10

Stove bolts in packages, with nuts attached 71

Stove bolts in bulk.....80

On stove bolts freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago, New York lots of 200 lb. or over.

Large Rivets

(½ in. and larger)

Base per 100 lb.

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham $3.75

Small Rivets

(7/16 in. and smaller)

Per Cent Off List

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham .....65 and 5

Cap and Set Screws

Per Cent Off List

Upset hex. head cap screws U.S.S. or S.A.E. thread, 1 in. and smaller	60
Upset set screws, cup and oval points	68
Milled studs	40
Flat head cap screws, listed sizes	30
Filister head cap, listed sizes	46

Freight allowed up to 65c. per 100 lb based on Cleveland, Chicago or New York on lots of 200 lb. or over.

WIRE PRODUCTS

(To the trade, f.o.b. Pittsburgh, Chicago, Cleveland, Birmingham)

Base per Keg

Standard wire nails	$2.55
Coated nails	2.55
Cut nails, carloads	3.85

Base per 100 Lb.

Annealed fence wire	$3.05

Base Column

Woven wire fence*	67
Fence posts (carloads)	69
Single loop bale ties	59
Galvanized barbed wire†	70
Twisted barbless wire	70

*15½ gage and heavier. †On 80-rod spools in carload quantities.

Note: Birmingham base same on above items, except spring wire.

BOILER TUBES

Seamless Steel and Lap Weld Commercial Boiler Tubes and Locomotive Tubes Minimum Wall

(Net base prices per 100 ft., f.o.b. Pittsburgh, in carload lots)

	Seamless Cold Drawn	Hot Rolled	Lap Weld, Hot Rolled
	$	$	$
2 in. o.d. 13 B.W.G.	15.03	13.04	12.38
2½ in. o.d. 12 B.W.G.	20.21	17.54	16.58
3 in. o.d. 12 B.W.G.	22.48	19.50	18.35
3½ in. o.d. 11 B.W.G.	28.37	24.62	23.15
4 in. o.d. 10 B.W.G.	35.20	30.54	28.66

(Extras for less carload quantities)

40,000 lb. or ft. over	Base
30,000 lb. or ft. to 39,999 lb. or ft.	5%
20,000 lb. or ft. to 29,999 lb. or ft.	10%
10,000 lb. or ft. to 19,999 lb. or ft.	20%
5,000 lb. or ft. to 9,999 lb. or ft.	30%
2,000 lb. or ft. to 4,999 lb. or ft.	45%
Under 2,000 lb. or ft.	65%

STEEL AND WROUGHT IRON PIPE AND TUBING

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

(F.o.b. Pittsburgh only on wrought pipe)

Base Price = $200 Per Net Ton

Steel (Butt Weld)

	Black	Galv.
½ in.	63½	51
¾ in.	66½	55
1 to 3 in.	68½	57½

Wrought Iron (Butt Weld)

½ in.	24	3½
¾ in.	30	10
1 and 1¼ in.	34	16
1½ in.	38	18½
2 in.	37½	18

Steel (Lap Weld)

2 in.	61	49½
2½ and 3 in.	64	52½
3½ to 6 in.	66	54½

Wrought Iron (Lap Weld)

2 in.	30½	12
2½ to 3½ in.	31½	14½
4 in.	33½	18
4½ to 8 in.	32½	17

Steel (Butt, extra strong, plain ends)

	Black	Galv.
½ in.	61½	50½
¾ in.	65½	54½
1 to 3 in.	67	57

Wrought Iron (Same as Above)

½ in.	25	6
¾ in.	31	12
1 to 2 in.	38	19½

Steel (Lap, extra strong, plain ends)

2 in.	59	48½
2½ and 3 in.	63	52½
3½ to 6 in.	66½	56

Wrought Iron (Same as above)

2 in.	33½	15½
2½ to 4 in.	39	22½
4½ to 6 in.	37½	21

On butt weld and lap weld steel pipe jobbers are granted a discount of 5%. On less-than-carload shipments prices are determined by adding 25 and 30% and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount or $4 a ton higher than Pittsburgh or Lorain on lap weld and one point lower discount, or $2 a ton higher on all butt weld 8 in. and smaller.

CAST IRON WATER PIPE

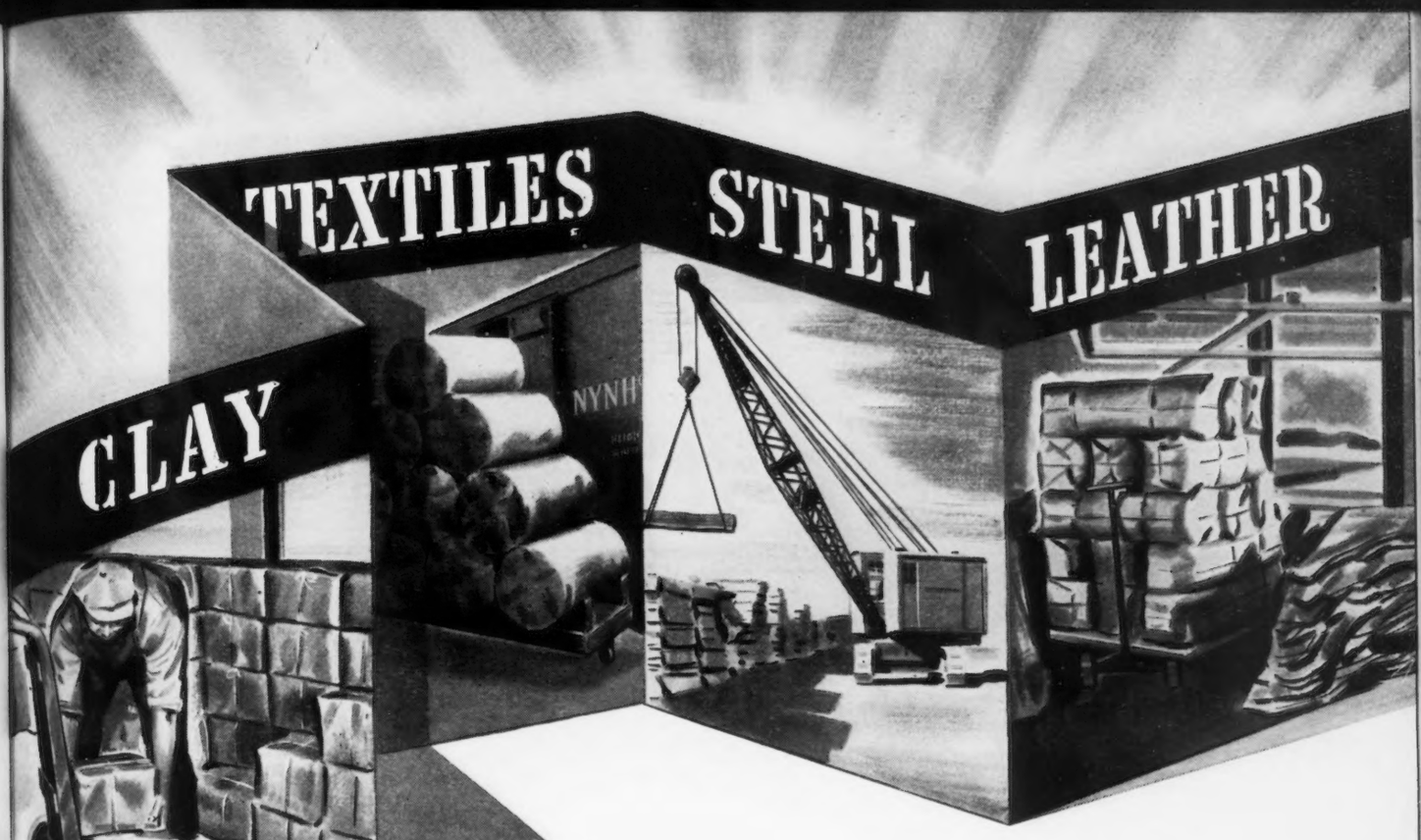
Per Net Ton

6-in. and larger, del'd Chicago	$54.80
6-in. and larger, del'd New York	52.20
6-in. and larger, Birmingham	46.00
6-in. and larger f.o.b. dock, San Francisco or Los Angeles or Seattle	56.00

Class "A" and gas pipe, $3 extra; 4-in. pipe is $3 a ton above 6-in. Prices shown are for lots of less than 200 tons. For 200 tons or over, 6-in. and larger is $45 at Birmingham and $53.80 delivered Chicago.

FUEL OIL

No. 3, f.o.b. Bayonne, N. J.	5.20c.
No. 6, f.o.b. Bayonne, N. J.	3.21c.
No. 6 Bur. Stds., del'd Chicago	4.50c.
No. 3 distillate del'd Cleveland	6.50c.
No. 4 indus., del'd Cleveland	6.00c.
No. 6 indus., del'd Cleveland	5.00c.



. . . or what do YOU have to WRAP and PROTECT?

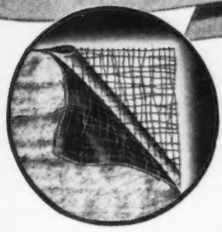
There's little or no similarity between these products. Each presents an entirely different problem in protection, during inside and outside storage as well as in transit — but FIBREEN serves them all — and hundreds of others too, large and small, in all types of industry.

Perhaps it can serve you. In factory after factory FIBREEN is doing a "better" job . . . speeding up the work in shipping rooms, reducing costs, and guarding against claims for damaged goods.

FIBREEN is amazingly strong and tough. It's waterproof, dirtproof, pliable and clean . . . an ideal wrapping and protective material, available everywhere at low cost.

Let us send you a supply of FIBREEN without cost or obligation, for you to try. Let The Sisalkraft Co. shipping experts offer recommendations. Simply write, explaining what you ship and how you now pack it.

FIBREEN



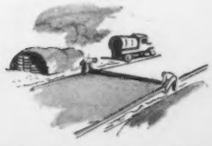
FIBREEN is 6 ply: TWO layers of strong kraft, reenforced with TWO layers of crossed sisal fibers embedded in TWO layers of special asphalt — all combined under heat and pressure. FIBREEN is pliable and clean — will not scuff—stands an astonishing amount of abuse and exposure. It is used either as a wrapping or a lining material.

Soak it — twist it — try to tear it!

Only when you get a sample in your own hands can you realize that a *paper* can be so strong—so tough—and impervious to moisture. Write for sample.

FIBREEN is a product of The Sisalkraft Co. — also manufacturers of Sisalkraft, Sisal-X, Sisal-Tape and Copper-Armored Sisalkraft.

THE SISALKRAFT CO.
205 W. WACKER DRIVE · CHICAGO, ILL.
NEW YORK · SAN FRANCISCO · LONDON · SYDNEY



SERVING INDUSTRY . . . . . CONSTRUCTION AND AGRICULTURE THROUGHOUT THE WORLD

FERROALLOYS

Ferromanganese

F.o.b. New York, Philadelphia, Baltimore, Mobile or New Orleans, Domestic, 80%, per gross ton (carloads).....$120.00

Spiegeleisen

Per Gross Ton Furnace

Domestic, 19 to 21%.....$36.00
Domestic, 26 to 28%..... 49.50

Electric Ferrosilicon

(Per Gross Ton, Delivered Lump Size)

50% (carload lots, bulk).....$74.50
50% (ton lots, packed..... 87.00
75% (carload lots, bulk).....135.00
75% (ton lots, packed).....151.00

Silvery Iron

(Per Gross Ton, base 6.00 to 6.50 Si)

F.O.B. Jackson, Ohio.....$29.50*
Buffalo $30.75*

For each additional 0.50% silicon add $1 a ton. For each 0.50% manganese over 1% add 50c. a ton. Add $1 a ton for 0.75% phosphorus or over.

*Official OPACS price established June 24.

Bessemer Ferrosilicon

Prices are $1 a ton above Silvery Iron quotations of comparable analysis.

Ferrochrome

(Per Lb. Contained Cr, Delivered Carlots, Lump Size, on Contract)

4 to 6 carbon.....13.00c.
2 carbon .....19.50c.
1 carbon .....20.50c.
0.10 carbon .....22.50c.
0.06 carbon .....23.00c.

Spot prices are ¼c. per lb. of contained chromium higher.

Silico-Manganese

(Per Gross Ton, Delivered, Lump Size, Bulk, on Contract)

3 carbon $113.00*
2.50 carbon 118.00*
2 carbon 123.00*
1 carbon 133.00*

Other Ferroalloys

Ferrotungsten, per lb. contained W, del'd carload.... $2.00
Ferrotungsten, 100 lb. and less $2.25
Ferrovanadium, contract, per lb. contained V, del'd $2.70 to $2.90†
Ferrocolumbium, per lb. contained Cb, f.o.b. Niagara Falls, N. Y., ton lots..... $2.25†
Ferrocarbontitanium, 15-18 Ti, 7-8 C, f.o.b. furnace, carload, contract, net ton.....$142.50
Ferrocarbontitanium, 17-20 Ti, 3-5 C, f.o.b. furnace, carload, contract, net ton.....$157.50
Ferrophosphorus, electric or blast furnace material, carloads, f.o.b. Anniston, Ala., for 18%, with $3 unitage freight, equalized with Rockdale, Tenn., gross ton..... $58.50
Ferrophosphorus, electrolytic 23-26%, carlots, f.o.b. Monsanto (Siglo), Tenn., $3 unitage, freight equalized with Nashville, gross ton..... $75.00
Ferromolybdenum, per lb. Mo, f.o.b. furnace ..... 95c.
Calcium molybdate, per lb. Mo, f.o.b. furnace..... 80c.
Molybdenum oxide briquettes 48-52 Mo, per lb. contained Mo, f.o.b. Langeloth, Pa.... 80c.
Molybdenum oxide, in cans, per lb. contained Mo, f.o.b. Langeloth, and Washington, Pa. 80c.

*Spot prices are $5 per ton higher.
†Spot prices are 10c. per lb. of contained element higher.

ORES

Lake Superior Ores (51.50% Fe.)

(Delivered Lower Lake Ports)

Per Gross Ton

Old range, bessemer, 51.50.... $4.75
Old range, non-bessemer, 51.50 4.60
Mesaba, bessemer, 51.50..... 4.60
Mesaba, non-bessemer, 51.50... 4.45
High phosphorus, 51.50..... 4.35

Foreign Ores*

(C.i.f. Philadelphia or Baltimore, Exclusive of Duty)

Per Unit

African, Indian, 44-48 Mn..65c. to 66c.
African, Indian, 49-51 Mn..67c. to 69c.
Brazilian, 46-48 Mn.....69c.
Cuban, 51 Mn .....78c.

Per Short Ton Unit

Tungsten, Chinese Wolframite, duty paid, delivered.....$24 to $26
Tungsten, domestic scheelite, at mine .....$24.00 to $25.00
Chrome ore, lump, c.i.f. Atlantic Seaboard, per gross ton; South African (low grade)..Nom.
Rhodesian, 45 .....$32.00
Rhodesian, 48 .....$39.00-$40.00

*Importations no longer readily available. Prices shown are nominal.

COKE*

Furnace

Per Net Ton

Connellsville, prompt ...$6.00 to $6.25

Foundry

Connellsville, prompt ...$6.75 to $7.00

*Maximum coke prices established by OPA became effective Oct. 1, 1941. A complete schedule of the ceiling prices was published in THE IRON AGE, Sept. 25, p. 94B. †F.O.B. oven.

By-product, Chicago $12.25
By-product, New England.....$13.75
By-product, Newark..$12.40 to $12.95
By-product, Philadelphia $12.38
By-product, Cleveland $12.30
By-product, Cincinnati $11.75
By-product, Birmingham .....$8.50†
By-product, St. Louis.....$12.02
By-product, Buffalo $12.50

RAILS, TRACK SUPPLIES

(F.o.b. Mill)

Standard rails, heavier than 60 lb., gross ton.....$40.00
Angle bars, 100 lb..... 2.70

(F.o.b. Basing Points) *Per Gross Ton*

Light rails (from billets).....$40.00
Light rails (from rail steel)... 39.00

Base per Lb

Cut spikes ..... 3.00c.
Screw spikes ..... 5.15c.
Tie plates, steel..... 2.15c.
Tie plates, Pacific Coast..... 2.30c.
Track bolts, heat treated, to railroads ..... 5.00c.
Track bolts, jobbers discount.. 63-5

Basing points, light rails—Pittsburgh, Chicago, Birmingham; spikes and tie plates—Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minneaqua, Colo., Birmingham and Pacific Coast ports; tie plates alone—Steelton, Pa., Buffalo; spikes alone—Youngstown, Lebanon, Pa., Richmond, Va

FLUORSPAR

Per Net Ton

Domestic washed gravel, 85-5 f.o.b. Kentucky and Illinois mines, all rail.....$25.00
Domestic, f.o.b. Ohio River landing barges 25.00
No. 2 lump, 85-5 f.o.b. Kentucky and Illinois mines..... 25.00
Foreign, 85% calcium fluoride, not over 5% Si, c.i.f. Atlantic ports, duty paid.....Nominal
Domestic No. 1 ground bulk, 96 to 98%, calcium fluoride, not over 2½% silicon, f.o.b. Illinois and Kentucky mines....$34.00
As above, in bags, f.o.b. same mines 36.40

REFRACTORIES

(F.o.b. Works)

Fire Clay Brick *Per 1000*

Super-duty brick, St. Louis...$64.60
First quality, Pennsylvania, Maryland, Kentucky, Missouri and Illinois 51.30
First quality, New Jersey..... 56.00
Second quality, Pennsylvania, Maryland, Kentucky, Missouri and Illinois 46.55
Second quality, New Jersey.... 51.00
No. 1, Ohio..... 43.00
Ground fire clay, net ton..... 7.60

Silica Brick

Pennsylvania $51.30
Chicago District 58.90
Birmingham 51.30
Silica cement, net ton (Eastern) 9.00

Chrome Brick *Per Net Ton*

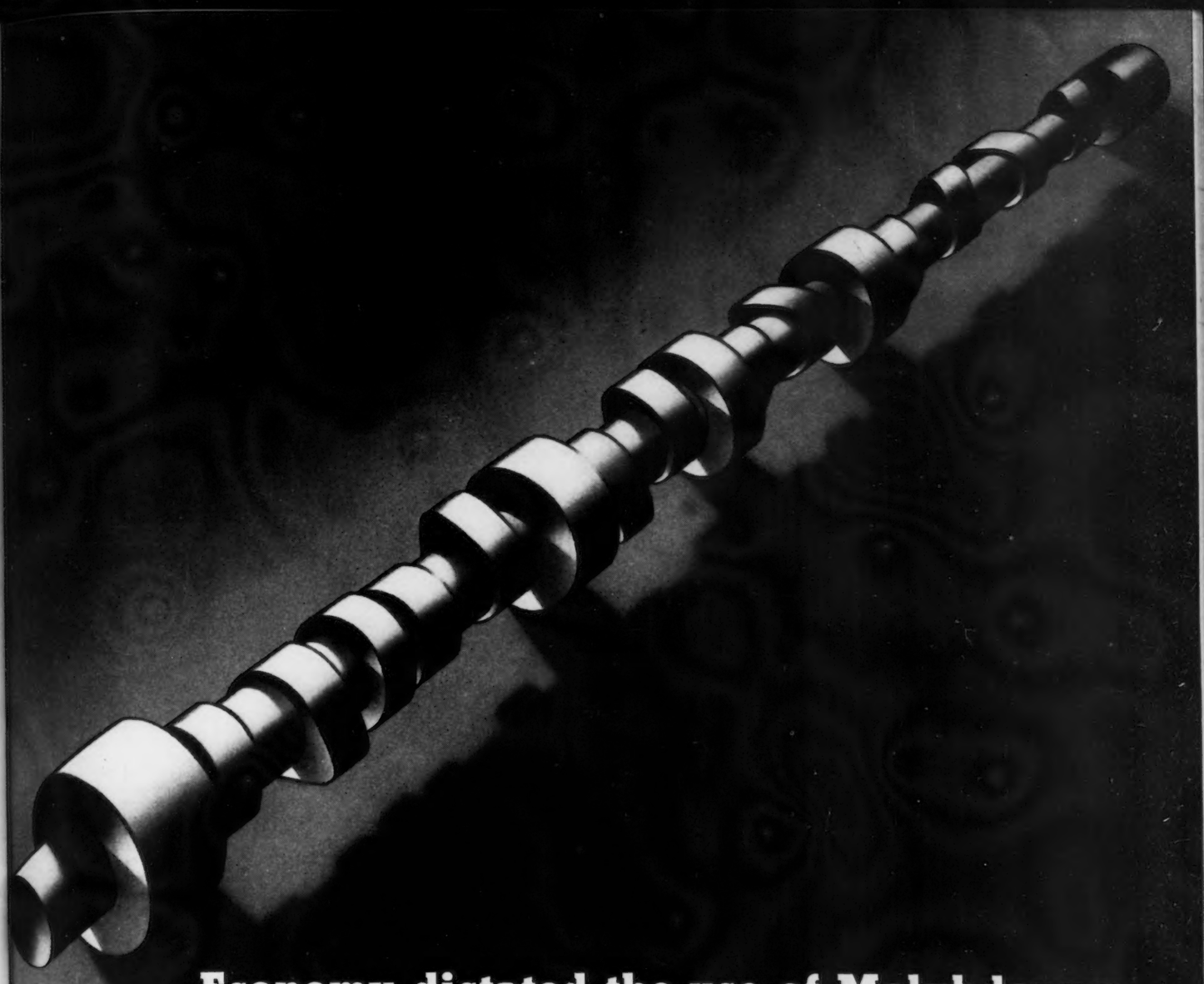
Standard, f.o.b. Baltimore, Plymouth Meeting and Chester...$54.00
Chemically bonded, f.o.b. Baltimore, Plymouth Meeting and Chester, Pa. 54.00

Magnesite Brick

Standard f.o.b. Baltimore and Chester $76.00
Chemically bonded, f.o.b. Baltimore 65.00

Grain Magnesite

Domestic, f.o.b. Baltimore and Chester in sacks.....$44.00
Domestic, f.o.b. Chewelah, Wash. (in bulk) 22.00



Economy dictated the use of Molybdenum to meet the stringent requirements in a cast iron camshaft.

The automotive industry requires certain minimum physicals, plus wear resistant properties, to make practical a cast iron camshaft. Machinability also, of course, is a factor.

The Chromium-Molybdenum-Nickel (0.40-0.60% Mo) iron which resulted from the search for the ideal, has an as cast tensile strength of 50,000 p.s.i., is rigid enough for the requirements and tough enough to stand up under the operating conditions.

The analysis of the iron makes possible economical, efficient flame hardening of the cams, with a good, strong case to core bond.

Ask for our free technical book, "Molybdenum in Cast Iron", giving full practical data.

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MOLYBDIC OXIDE BRIQUETTES FOR THE CUPOLA—FERROMOLYBDENUM FOR THE LADLE

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500 Fifth Avenue · New York City

MOLY

SALES POSSIBILITIES

. . . CONSTRUCTION, PLANT EXPANSION AND EQUIPMENT BUYING

North Atlantic States

• **Westinghouse Electric & Mfg. Co.,** Springfield, Mass., plans two-story addition, about 80 x 280 ft., to replace a former unit at plant. Cost over $100,000 with equipment.

Quartermaster, Springfield Armory, Springfield, Mass., has let general contract to Casper Ranger Construction Co., Holyoke, Mass., for one-story addition for storage and distribution, at $193,000 exclusive of equipment.

Holo Krome Screw Corp., Brook Street, West Hartford, Conn., socket head screws, socket wrenches, etc., has let general contract to R. G. Bent Co., 93 Edwards Street, Hartford, for one-story addition for expansion in heat-treating and main production division. Cost close to $40,000 with equipment.

Public Service Co. of New Hampshire, Manchester, N. H., has approved plans for expansion and improvements in former steam-electric power plant at local Amoskeag Mills, to be used for central station service. Cost close to $100,000 with equipment. J. H. & J. C. Stevens, 187 Middle Street, Portland, Me., are architects.

Wickwire Spencer Steel Co., Worcester, Mass., has begun work on new one-story plant, 104 x 150 ft., at Palmer, Mass., for which general contract recently was let to Aberthaw Co., 80 Federal Street, Boston. Cost over $85,000 with equipment.

Board of Selectmen, Danbury, Conn., has plans by Philip N. Sunderland, Inc., 81 West Street, architect, for new two-story trade school at Osborn and Ninth Streets. Cost close to $240,000 with equipment.

Union Mfg. Co., 296 Church Street, New Britain, Conn., overhead trolleys, hoists, etc., will begin superstructure soon for two one-story additions for expansion in forge shop. Wexler Co., 286 Hart Street, is general contractor. Cost about $45,000 with equipment. Delbert K. Perry, 17 Court Street, is architect.

Corn Products Refining Co., 17 Battery Place, New York, plans one-story addition, 150 x 200 ft., to branch plant at Argo, Ill. Cost over $125,000 with equipment. Schmidt, Garden & Erickson, 104 South Michigan Avenue, Chicago, are architects.

Nova Electric Co., Inc., New York, has leased about 25,500 sq. ft. of floor space in building at 34 Hubert Street, for manufacture of electrical appliances and kindred equipment.

Continental Oil Co., 10 Rockefeller Plaza, New York, plans expansion in oil refinery at Lake Charles, La., for high octane gasoline production for aviation service. Installation will include towers, boilers, pumping units, exchangers, steel tanks and auxiliary equipment. Cost close to $400,000 with machinery.

Department of Public Works, Municipal Building, New York, plans extensions and improvements in power plant at Bellevue Hospital, foot of East Twenty-sixth Street. Cost over $100,000 with equipment.

Continental Can Co., 100 East Forty-second Street, New York, has superstructure under way on new one-story plant, 140 x 450 ft., at Mankato, Minn. Austin Co., Cleveland, is general contractor. Cost over $600,000 with equipment.

Department of Public Works, Municipal Building, New York, plans two-story machine and repair shop at yard at 41-02 123rd Street, Corona, L. I. Cost close to $90,000 with equipment.

Liquidometer Corp., 36-16 Skillman Avenue, Long Island City, New York, liquid level gages for tanks and kindred mechanical products, is erecting new two-story plant at 41-95 Thirty-sixth Street, for which general contract recently was let to P. Kretzer & Son, 58-28 Queens Boulevard, Woodside, L. I. Cost close to $60,000 with equipment. Charles M. Lobejager, 54-19 Roosevelt Avenue, Woodside, is architect.

National Carbon Co., Inc., 3625 Highland Avenue, Niagara Falls, N. Y., carbon electrodes, graphite specialties, etc., has asked bids on general contract for one-story addition, about 60 x 115 ft. Cost over $80,000 with equipment. Main offices are at 30 East Forty-second Street, New York.

Bell Aircraft Corp., 2050 Elmwood Avenue, Buffalo, has leased 43,000 sq. ft. of floor space in building at 2495 Main Street, owned by Ford Motor Co., for special mechanical work and research.

Electro Metallurgical Co., 137 Forty-seventh Street, Niagara Falls, N. Y., has let general contract to Hughes-Foulkrod Co., Schaff Building, Philadelphia, for two two-story additions to branch plant at Alloy, W. Va., about 60 x 60 ft., and 45 x 60 ft. Cost over $55,000 with equipment.

Standard Buffalo Foundry, Inc., 743 Hertel Avenue, Buffalo, gray iron castings, plans one-story addition for a welding works. Cost close to $40,000 with equipment.

Wood Newspaper Machinery Corp., 688 South Second Street, Plainfield, N. J., printing machinery, parts, etc., plans expansion for production of ordnance equipment for government. Equipment will cost about $335,950, fund to be furnished by Defense Plant Corp., Washington.

American Steel Castings Co., Avenue L and Edwards Street, Newark, N. J., has let general contract to Walter Kidde Constructors, Inc., 140 Cedar Street, New York, for one-story addition for expansion in foundry, machine shop and pattern shop, for production for government. Cost close to $300,000 with equipment, fund to be furnished by Defense Plant Corp., Washington.

R. M. Hollingshead Corp., Camden, N. J., industrial chemicals, lubricants, etc., has arranged for purchase of entire plant of Stylepark Hats, Inc., River Road and East State Street, on six-acre tract, occupied in part for past few months, following fire which destroyed plant at Sixteenth and Mickle Streets. Former owner will vacate at early date, and Hollingshead company will install additional equipment and facilities.

John A. Cozzone & Co., 20 Kent Street, Newark, N. J., screw machine products, have let general contract to Schaedel & Brother Co., Inc., 130 Bruce Street, for one-story addition. Cost over $50,000 with equipment. William A. Kinsey, 207 Market Street, is engineer.

Port Newark Shipbuilding Corp., Port Newark, Newark, N. J., and 17 Battery Place, New York, recently organized, will build four additions to shipyard at first mentioned place, in conjunction with modernization and improvements recently noted. Structures will include a one-story mold loft, 300 x 350 ft.; two-story storage and distributing building, 75 x 150 ft.; power house, 75 x 75 ft.; and two-story office and operating structure, 100 x 300 ft. Entire project will cost over $400,000.

Construction Quartermaster, Twentieth and Johnston Streets, Philadelphia, has let general contract to Hughes-Foulkrod Co., Schaff Building, for one-story shop at Frankford Arsenal, at $742,000, exclusive of equipment. It will be used for optical production works, including lense grinding and other precision manufacture.

W. L. Brubaker & Brothers Co., Millersburg, Pa., taps, dies, reamers, etc., will carry out expansion for production of machine tool specialties for government. Equipment to cost about $55,000 will be installed, fund in that amount to be provided by Defense Plant Corp., Washington.

Drever Co., 748 East Venango Street, Philadelphia, furnaces, parts, etc., has leased part of plant of American Ice Co., American, Cambria and Phillip Streets, for expansion to carry out defense production.

United Engineering & Foundry Co., First National Bank Building, Pittsburgh, rolling mill equipment and other heavy machinery, castings, etc., plans one-story addition to branch plant at Youngstown for expansion in assembling division. Cost about $500,000 with equipment.

Ajax Iron Works, Inc., Corry, Pa., engines and parts, car movers and other heavy machinery, has let general contract to Henry Shenk Co., 1115 Sassafras Street, Erie, Pa., for one-story addition, about 55 x 150 ft., for expansion in machine shop. Cost over $75,000 with equipment.

General Electric Co., Schenectady, N. Y., has contract with Navy Department, Washington, for new plant near works at Erie, Pa., for production of electrical equipment for Navy. Cost about $10,430,000, of which approximately $7,980,000 will be used for machinery and other equipment, remainder for land and buildings. Gross fund in amount noted will be furnished by Defense Plant Corp., Washington.

Bureau of Yards and Docks, Navy Department, Washington, asks bids (no closing date stated) for water purification plant at Naval Experimental Model Basin, Carderock, Md., including circulating and sump pumps, chemical mixing tank, flow meter, piping and instruments, filter apparatus, etc. (Specification 10681).

Suburban Club Beverage Co., 1808 Paterson Park Avenue, Baltimore, has let general contract to Consolidated Engineering Co., 20 East Franklin Street, for one-story addition to mechanical-bottling works. Cost close to $50,000 with equipment.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Dec. 23 for acid pumps for yards at East Greenwich, R. I., Jacksonville, Fla., and Corpus Christi, Tex. (Schedule 9606); until Jan. 8 for 33,900 ft. of non-metallic gasoline hose (Schedule 9645), 1880 ft. of flexible metallic steam hose (Schedule 9634) for Eastern and Western yards.

The South

• **Wright's Automatic Tobacco Packing Machine Co.,** Durham, N. C., packaging, filling and other special machinery and parts, will carry out further expansion for production for government, for which an initial fund of $500,000 has been secured through Defense Plant Corp., Washington, to be increased by $100,000 for additional work noted.

United States Engineer Office, Louisville, asks bids until Jan. 7 for construction of pumping plants at Paducah, Ky., in conjunction with flood protection works.

Clark Rural Electric Cooperative Corp., Winchester, Ky., plans new steam-electric generating station for power supply for rural electric system; also will build new transmission and distributing lines. Entire project will cost about $2,000,000. Financing will be arranged through Federal aid.

Pepsi-Cola-Orange Crush Bottling Co., Norfolk, Va., plans new two-story mechanical-bottling, storage and distributing plant on Debree Avenue, near Twenty-fourth Street, 75 x 195 ft., with central section, 50 x 75 ft., and two one-story wings. Cost close to $75,000 with equipment.

Southern Oxygen Co., Arlington, Va., industrial gases, welding apparatus, industrial oxygen, etc., plans new industrial gas-generating plant on 20-acre tract on River Road, near Bladensburg, Md. Cost close to $100,000 with machinery.

United States Engineer Office, Huntington, W. V., asks bids until Dec. 22 for 16 5-ft. 8-in. x 10 ft. sluice gates, eight complete assemblies; and for two 5 ft. 8-in. x 6 ft. emergency sluice gates, two complete assemblies, for Bluestone dam, Hinton, W. Va.

Virginia Public Service Co., Alexandria, Va., will begin work soon on addition to local

BURLY BOLTS AND A NUT *just as Tough*

Whether you're building a bridge or a tractor, a tank or a tunnel, you'll be using some of these big, black bolts from LAMSON sometime. And if there's vibration to contend with, or sudden shocks to withstand, then you should use these very tough LAMSON Lock Nuts. These lock nuts have undergone such strenuous tests as holding on the shaker screens for coal mining operations—have withstood the pounding abuse of pneumatic hammers—the twists and stresses of chassis assemblies of giant trucks on the highways—and stayed grimly on the job until removed with muscle and wrench. They do not let go voluntarily. You just have to take them off yourself. But even then they can be used again and will hold on just as tightly as before. If unfamiliar to you, ask for samples.

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Plants at Cleveland and Kent, O.; Chicago and Birmingham

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steam-electric generating station, to include installation of new 15,000-kw. turbine-generator unit and accessories, boiler and auxiliary equipment. Cost close to $1,500,000 including transmission line extensions, power substations and other facilities.

Board of Education, Durham, N. C., plans new one and two-story vocational school. Cost over $250,000 with equipment.

American Viscose Corp., Roanoke, Va., has approved plans for one-story addition for expansion in processing department. Cost over $50,000 with equipment.

Dow Magnesium Corp., subsidiary of Dow Chemical Co., Midland, Mich., has let contract to Austin Co., Cleveland, for new mill for production of metallic magnesium for government, near Velasco, vicinity of Freeport, Tex. It will include machine shop, power house, pumping station, administration building, storage and distributing structures, and other units. Cost close to $50,000,000, fund in that amount to be furnished by Defense Plant Corp., Washington.

Quartermaster, Normoyle Quartermaster Depot, San Antonio, Tex., asks bids until Dec. 29 for one motor-driven air compressor, capacity 900 cu. ft. per min., with accessory equipment (Circular 632-31).

Central States

● **General Machinery Corp.,** Third Street, Hamilton, Ohio, machine tools, parts, etc., has let general contract to Ferro Concrete Construction Co., Third and Elm Streets, Cincinnati, for two-story addition, for manufacture of diesel engine equipment for government. Cost over $300,000 with machinery.

General Electric Co., Schenectady, N. Y., has let general contract to Warren Engineering Co., Warren, Ohio, for one-story addition to branch plant at Jefferson, Ohio, for expansion in welding department. Cost about $60,000 with equipment.

Robinson-Houchin Optical Co., 515 West First Avenue, Columbus, Ohio, will take bids at once on general contract for three-story addition, about 40 x 50 ft. Cost over $65,000 with equipment.

Columbus Show Case Co., Inc., 850 West Fifth Avenue, Columbus, Ohio, store fixtures, display cases, etc., plans one-story addition, about 100 x 100 ft. Cost over $50,000 with equipment.

State Department of Public Welfare, State Office Building, Columbus, Ohio, C. L. Sherwood, director, plans early call for bids for new boiler, stoker and auxiliary equipment for installation in power house at State Reformatory, Delaware, Ohio.

F. & F. Mold & Die Works, Inc., Quitman Street, Dayton, Ohio, steel dies, molds, etc., has let general contract to Carl Schultheis, 2415 Hillview Avenue, for new one-story plant at Sacks and Prudent Streets. Cost close to $40,000 with equipment. Frank Sutter, Fifth and Jefferson Streets, is architect.

Buckeye Rural Electric Cooperative, Inc., Gallipolis, Ohio, plans new steam-electric generating station for power supply for rural electric system. Cost over $200,000 with equipment. Financing will be arranged through federal aid.

P. R. Mallory Co., Inc., 3029 East Washington Street, Indianapolis, electrical and precision instruments and equipment, bearings, etc., has purchased local branch factory of Ford Motor Co., at 1315 East Washington Street for expansion.

Fort Wayne Tool, Die & Engineering Co., East Columbia Street, Fort Wayne, Ind., plans one-story addition. Cost close to $100,000 with equipment.

Scullin Steel Co., 6700 Manchester Street, St. Louis, plans new plant on three-acre adjoining site for production of welded armor plate for army tanks for government. It will comprise large one-story units with smaller buildings for storage, distribution and other service. Entire project will cost about $2,600,000, of which about $2,100,000 will be used for equipment. Fund in gross amount will be supplied by Defense Plant Corp., Washington.

Glenn M. Dunne, head of Dunne-Isreal Co., Wichita, Kan., and C. W. Hoffman, an official of Huber Carbon Black Co., Borger, Tex., are organizing a company to build and operate a carbon black plant at Hugoton, Kan., where site has been secured. It will comprise processing units, with compressor station, boiler house, machine shop, storage and distributing buildings and other facilities, including pipe lines for gas supply. Cost about $300,000 with equipment.

Extruded Metals Defense Corp., Belding, Mich., subsidiary of Extruded Metals, Inc., same place, recently organized to construct and operate a new plant at Grand Rapids, Mich., has plans by H. D. Ilgenfritz, 468 Prentis Street, Detroit, architect. It will comprise a main one-story unit, about 250,000 sq. ft. of floor space, for production of extruded aluminum metals for government, with auxiliary structures for storage, distribution, etc., power house and other buildings. Entire project will cost about $6,266,000, fund in that amount will be furnished by Defense Plant Corp., Washington; equipment will cost about $3,966,000 of gross sum.

Giern & Anholtt Tool Co., 1312 Mount Elliott Avenue, Detroit, tools and other mechanical equipment, has let general contract to Robert Tillotson, Bloomfield Hills, Mich., for one-story addition. Cost close to $40,000 with equipment.

Detroit Diesel Engine Division, General Motors Corp., 13400 West Outer Drive, Detroit, plans one-story addition. Cost close to $100,000 with equipment.

Eaton Mfg. Co., Wilcox-Rich Division, Saginaw, Mich., automotive equipment, has plans by George S. Rider Co., Terminal Tower Building, Cleveland, architect, for one-story addition for production of aircraft parts for government. Cost about $465,200 with equipment, fund in that amount to be furnished by Defense Plant Corp., Washington.

Haskelite Mfg. Corp., Grand Rapids, Mich., metal-covered wood specialties, has begun work on one-story addition, for which general contract recently was let to Owen-Ames-Kimball Co., Grand Rapids. Cost close to $50,000 with equipment. Main offices are at 208 West Washington Street, Chicago.

Central Pattern & Foundry Co., 3737 South Sacramento Avenue, Chicago, aluminum, bronze and brass castings, plans new one and two-story plant, 100 x 125 ft., at Sacramento Avenue and Thirty-eighth Street. Proposed to carry out work next spring. Kocher & Larson, 506 West Sixty-third Street, are architects.

Aetna Ball Bearing Mfg. Co., 4600 West Schubert Street, Chicago, ball bearings, thrust bearings, washers, etc., plans expansion for production of roller thrust bearings for propellers for government. Equipment installation is estimated at $410,500, fund in that amount to be provided by Defense Plant Corp., Washington.

Nordberg Mfg. Co., 3073 South Chase Avenue, Milwaukee, engines, compressors, hoists, etc., plans one-story addition, about 36 x 140 ft., for expansion in foundry. Cost over $60,000 with equipment.

Union Pacific Railway Co., Fifteenth and Farnham Streets, Omaha, Neb., has let general contract to James Leck Co., 211 South Eleventh Street, Minneapolis, for new one-story engine house with shop facilities, 40 x 200 ft., at Green River, Wyo. Cost close to $90,000 with equipment. Also has made award to same contractor for similar engine house and shop at yards at Ogden, Wyo., to cost about like amount. Company is rebuilding locomotive repair and construction shops at Cheyenne, Wyo., destroyed by fire several months ago, and for which general contract has been let to Leck company, including main one-story shop, 100 x 176 ft., for wheel, tank and other divisions, with smaller adjoining shop units. Entire project will cost close to $500,000 with equipment.

Rysdon Sheet Metal Works, Inc., 3315 South Wallace Street, Chicago, sheet metal products, has filed plans for two-story addition, about 26 x 125 ft., for which general contract recently was let to M. Klarich, 3121 South Parnell Avenue. Cost about $40,000 with equipment. L. I. Janik, 343 South Dearborn Street, is architect.

Sterling Motor Truck Co., Inc., South Fifty-fourth Street, West Allis, Wis., motor trucks and parts, has let general contract to Gebhard-Berghammer, Inc. 5420 West State Street, Milwaukee, for one-story addition, 100 x 104 ft., for expansion in main shops. Cost over $50,000 with equipment. U. F. Peacock, 3200 West Wisconsin Avenue, Milwaukee, is architect.

City Council, Waverly, Iowa, plans expansion and improvements in municipal power plant, including new 700-kw. generating unit, and auxiliary equipment. Cost about $90,000.

Western States

● **Douglas Aircraft Co., Inc.,** 3000 Ocean Park Boulevard, Santa Monica, Cal., plans four shop additions, three for machine shops, of which two will be 75 x 100 ft., and other 60 x 100 ft.; and fourth structure for tooling shop, 50 x 150 ft. Cost close to $200,000 with equipment.

Bureau of Reclamation, Denver, asks bids until Dec. 30 for eight vertical welded steel storage tanks for Boulder shipyards, Boulder Canyon project (Specification 1600-D). Also until Jan. 5 for three 108,000-kva., 13,809-volt, 60-cycle, vertical-shaft, a.c. electric generators for Grand Coulee power plant, Wash. (Specification 1018).

Western Pipe & Steel Co., Inc., 5717 South Santa Fe Avenue, Los Angeles, has leased 34-acre tract on west basin, Los Angeles harbor, with city harbor commission, as site for new shipbuilding plant for construction of vessels for government. Project will include several shipways, metal-working, wood-working, pipe and other shops. Cost about $3,500,000 with equipment.

Commercial Iron Works, Inc., 912 S. E. Stephens Street, Portland, has filed plans for shop additions at shipyard at 3416 S. W. Moody Avenue. Cost about $80,000 with equipment.

Vega Airplane Co., 923 South San Fernando Road, Burbank, Cal., plans one-story shop addition, 90 x 120 ft., to plant No. 2. Cost over $85,000 with equipment.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Jan. 6 for six motor-driven, heavy-duty shapers for Puget Sound Navy Yard (Schedule 9654); one motor-driven jig borer with electrical equipment (Schedule 9655); until Jan. 9, three motor-driven universal tool and cutter grinders (Schedule 9733), for Mare Island yard, Cal.

H. W. Load Machine Works, 969 East Second Street, Pomona, Cal., machinery and parts, has approved plans for one-story shop addition, 53 x 122 ft. Cost close to $40,000 with equipment.

Canada

● **Construction Equipment Co., Ltd.,** 180 Vallee Street, Montreal, has let general contract to Foundation Co. of Canada, Ltd., 1538 Sherbrooke Street West, for additions to shops at Dorval, Que., comprising one-story machine shop, boiler house, one-story storage and distributing building and auxiliary structures. Cost over $85,000 with equipment.

Brandon Packers, Ltd., Brandon, Man., has approved plans for one-story addition to main processing and packing plant, and new boiler house. Cost about $65,000 with equipment.

Canadian Westinghouse Co., Ltd., 288 Sanford Avenue, North, Hamilton, Ont., has begun erection of three-story addition, 30 x 100 ft., for which general contract recently was let to W. H. Yates Construction Co., Ltd., 400 Wellington Street North. Cost close to $100,000 with equipment. Hutton & Souter, Piggott Building, are architects.